AD-A103 436 ARCHEOLOGICAL RESEARCH ASSOCIATES TULSA OK F/G 5/6
A REASSESSMENT OF CERTAIN ARCHEOLOGICAL SITES IN THE CANDY LAKE--ETC(U)
1980 J SAUNDERS, C D CHEEK, F NIALS DACW56-79-C-0040
UNCLASSIFIED RR-22 NL

1 OF 3
AD
A103436

OF 3

03436

4

A REASSESMENT OF CERTAIN ARCHEOLOGICAL SITES

IN

THE CANDY LAKE AREA, OKLAHOMA

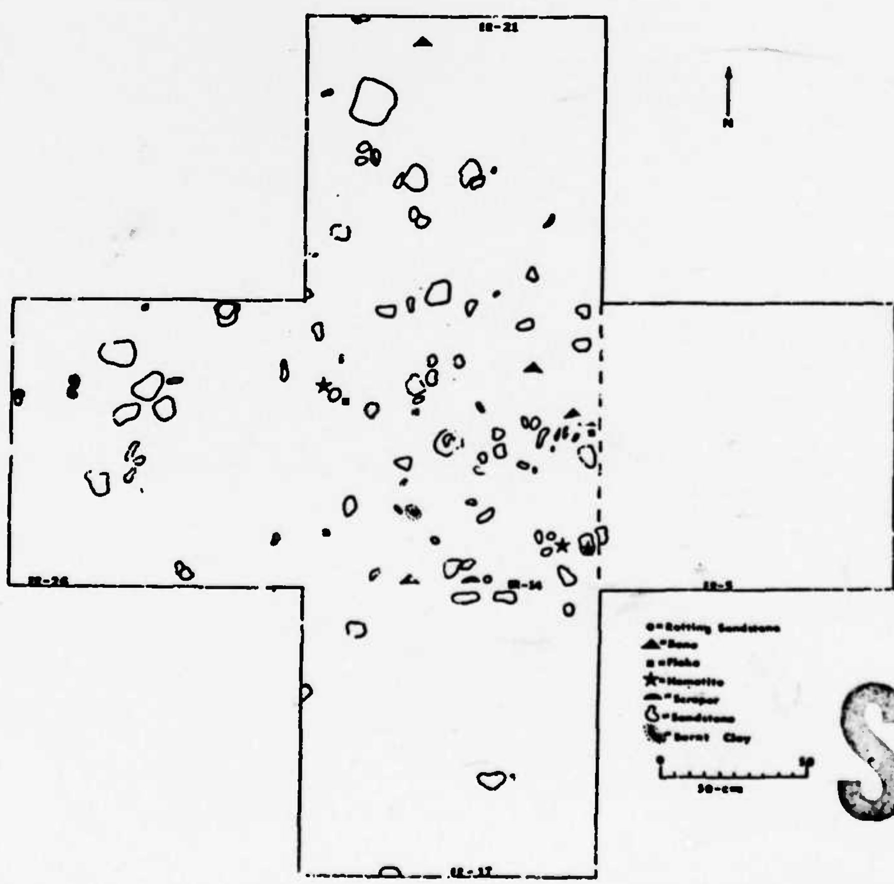
by

Joe Saunders

With contributions by
Charles D. Cheek and Fred Nials

Annetta L. Cheek, Principal Investigator

Archeological Research Associates Research Report No. 22
Tulsa, Oklahoma



LEVEL II

(4)

(6) A REASSESSMENT OF CERTAIN ARCHEOLOGICAL SITES

IN

THE CANDY LAKE AREA, OKLAHOMA.

(11) 1980

(12) 234

By

(10) Joe Saunders

~~With Contributions~~ by

Charles D. Cheek ~~and~~ Fred Nials

Accession For	
NTIS GRA&I	X
DTIC TAB	☐
Unannounced	☐
Justification	
By Per Ltr. on file	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A	

Principal Investigator

Annetta L. Cheek

Submitted in partial fulfillment of
Contract No. DACW56-79-C-0040 new
Corps of Engineers, Tulsa District

(15)

(14) RR-22

DTIC ELECTE AUG 28 1981

D

(9)

Archeological Research Associates Research Report No. 22

Tulsa, Ok~~lahoma~~

1980

DISTRIBUTION STATEMENT A
Approved for public release;
Distribution Unlimited

412494

ACKNOWLEDGMENTS

I wish to thank Dr. Annetta Cheek for her comments and constant state of good humor; Britt Bousman for his assistance and social observations; Steve Conley for putting up with my incessant demands in the lab, Bob Darcy for his expert advice on statistical matters, Sharon Phillips for typing this report from my first draft, and especially Bill, Marylin, and Dylan Westbury for their support and encouragement.

I wish also to thank the Tulsa Corps of Engineers for their help with this project, and especially Larry Banks of the Dallas office for helping with the identification of raw materials.

Charles Cheek contributed extensively to Chapter 2, as well as supplying general editing and organizational help, especially of Chapter 10. He is also responsible for reinterpretations of the stratigraphy (Chapter 9) based on C-14 dates, which became available after I left the project; he also wrote Chapter 11, the conclusion.

ABSTRACT

Three sites were investigated in the proposed Candy Creek Lake Area. One, Os-155, was excavated; two others, Os-149 and Os-153, were tested. The work was done under a contract with the Tulsa District Corps of Engineers.

The two tested sites did not contribute significant information on the prehistory of the region. The third site, Os-155, contained three separate occupation areas. Radiometric dates and a study of the geomorphology of the areas established that one area contained a Late Archaic component deposited before the formation of the Copan paleosol, while the other two areas exhibited Late Woodland components laid down either immediately before or during the formation of the paleosol. The analysis of the lithic and other cultural material suggested that each component was the remains of a transient campsite of a small group of people at which a wide range of cultural activities were performed. The report also examines the possible causes of the observed variability in the lithic assemblages and relates it primarily to differences in raw material selection.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

During the winter and summer of 1979, Archeological Research Associates, under U.S. Army Corps of Engineers contract DACW56-79-C-0040, tested three prehistoric sites within the proposed Candy Creek Lake . The investigations were concerned with testing two sites, Os-149 and Os-153, recommended by Cheek and Wilcox (1974), and continuing the investigations of the cultural resources at Os-155, a site which had previously been tested by Leehan in 1976.

The principal concern of the 1979 season was to secure an increase in cultural debris in order to estimate the temporal affiliations and functional purpose of the sites within the Candy area. The work was conducted in two phases, one in the spring, directed by Dan Crouch, and one in the summer, directed by myself. The first phase included testing at Os-149 and Os-153, both of which were found to contain only very limited cultural materials, as well as work at Os-155. The second phase was limited to further work at Os-155.

This report includes brief discussions of the prehistoric, geomorphic, and environmental settings of the study area. Previous and present field work are described, as are field methods and laboratory procedures used. Results of the field work and of edge wear analysis of the tools and studies of the lithic debitage comprise the major analytic sections of the report. The analytical section is followed by the Conclusion.

CHAPTER 2

ARCHEOLOGICAL BACKGROUND

A number of excellent reviews of the archeology in northeastern and eastern Oklahoma have recently been published (Cheek 1977, Henry 1977a, 1977b; Farley and Keyser 1979). Subsequently, this section will focus on the settlement and social structural implications of the chronological sequence for Candy Creek and the surrounding area.

Paleo Indian (8000? B.C.-5000 B.C.)

To date, isolated surface finds provide the only data for the Paleo Indian occupation (Cheek 1977). No documented remains of this stage have been found in the Candy area.

Archaic (5000 B.C. -A.D.1)

During the Archaic stage, the population density in northeastern and eastern Oklahoma increased. Generally, this increase has been associated with the development of localized adaptive strategies, as demonstrated by the procurement of local game and flora, and the creation of regionally specific artifact types (Cheek 1977).

The Archaic campsite can be characterized as containing a generalized tool assemblage required for the exploitation of faunal and floral resources; large, stemmed bifaces; and a full array of lithic tools and grinding stone implements. The distinction among the recorded sites

apparently consists of a variation in the density of cultural material and presence or absence of archeological features. For example, the Lawrence Site (Baldwin 1969), the Lightning Creek Site (Baldwin 1970), the Dickson-Haraway Site (Burton and Neal 1970), the Scott and Wann sites (Galm and Flynn 1978), and the Sallee Creek Site (Bobalik 1978) represent dense occupations which contain evidence of fire hearths and/or rock concentrations. The Easton (Hofman 1975) and Webber's Falls sites (Schneider 1967), on the other hand, lack archeological features but still represent the general spectrum of the Archaic tool assemblage. The different densities of cultural material on Archaic sites could be due to a number of factors: repeated occupation, occupation by larger groups, continuous occupation for an extended period of time, or a combination of these factors. Why some sites have features and others do not is an unanswered question, but may be related to length of site occupation and/or procurement or processing activities undertaken at each site.

Since the tool kit seems to remain basically the same among sites with dense and less dense occupations, it appears that the exploitation system of Archaic peoples was one characterized by a series of successively occupied site localities from which all the basic subsistence pursuits were conducted. Based on current evidence such groups may have lacked specialized sites restricted to single activities. The sample of sites on which this generalization is made is, of course, biased because the larger sites are those which are the first deemed worthy of excavation and because many Archaic sites are probably buried under alluvium (Vehik, Buehler, and Wormser 1979; Salisbury 1980:132). We thus

may lack an adequate picture of the subsistence settlement pattern. However, enough sites have been found to consider this a working hypothesis.

The apparent lack of specific activity site occupations (with hunting/collecting only) is reminiscent of the settlement pattern observed among the Bushmen by Lee (1965), Silverbauer (1965), Lee and DeVore (1976), and Yellen (1977). The movement of the Bushmen was characterized by individual bands exploiting the seasonal resources. The activity patterning within each site represented a conglomeration of hunting and gathering. The variance among the sites was manifested only in the density of the material remains. Within the seasonal rounds, sites which exhibited the highest material density were those situated near permanent water sources. Water was a critical resource for the Bushmen, and these sites witnessed frequent reoccupation and longer occupation than other sites. Permanent water is a critical resource for the Archaic groups of Oklahoma also, but since it was not localized, it is not likely that it acted as the determinant of intensity of site occupation as it did among the Bushmen. However, there may be other critical localized resources such as nut groves or lithic raw material sources which did influence occupation occurrence or intensity. Other things being equal, sites with intensive occupations might be found near such critical resources more frequently than in other areas.

One such resource that likely was influential in site location is lithic material. In areas rich in lithic resources, the local material will predominate in both intensively occupied and less intensively occupied sites. The assemblages from four Weber Falls sites, the Lightning Creek Site, the Dickson-Haraway Site, the Easton Site, the Sallee

Creek Site, and the Scott and Wann sites each are composed predominantly of local lithic resources (Schneider 1967:18, 31, 57, 68; Baldwin 1970: 14; Burton 1970:25; Hofman 1975:14, Bobalik 1978:110, 115; Galm and Flynn 1978:151). Sites in regions without local raw material sources have less potential to contain intensively occupied sites, unless trade and/or an efficient lithic reduction technology is established. Given these relationships, then perhaps it could be postulated that the distribution of lithic resources partially controlled settlement patterns during the Archaic.

Other factors may also have been influential. The Archaic peoples apparently represent the first groups to use eastern Oklahoma on a relatively permanent basis. It would be logical to assume that the areas which contained the necessary materials for adapting successfully to a new environment would be subject to earliest settlement and the Candy area, lacking lithic sources, may not have been a favored region. Secondly, the initial occupation phase could possibly lack the developed social structure considered necessary for the successful implementation of permanent trade networks, further restricting lithic availability in non-source areas. Finally, the occurrence of sites which systematically contain a generalized tool kit may in fact reflect the nature of the social organization of the culture. The absence of specialized sites may indicate that the Archaic peoples were egalitarian in social structure, as were the Bushmen studied by Lee, Silverbauer, and Yellen. Additional support for this hypothesis can be found in the ethnographic literature, in Turner's work on the Cree and Australian Aboriginals (1978). In the first society, which is egalitarian like the Bushmen but exists in a

different environmental setting, there are no special task groups and therefore no special activity sites. Among the Aboriginals, which are hierarchical and authoritarian in their interpersonal relationships, specialized task groups do exist as do specialized task sites.

Thus, in two ethnographic situations with different environments, egalitarian societies are associated with the tendency for sites to exhibit no evidence of activity specialization. One other hunting/gathering group, without an egalitarian structure, does have activity and site specialization. Therefore, if the production and dispersal of material items reflects the social structure of the producing social actors, we probably should not expect to locate specialized activity sites during a period in which the apparent social structure was egalitarian.

In summary, several propositions can be suggested to explain settlement/subsistence systems among the Archaic--and later--prehistoric populations in Oklahoma. These include the effect of localized lithic resources on site distribution and the causes of specialized activity sites. Such hypotheses may be productively tested in the future.

Plains Woodland (A.D. 1-900)

The Plains Woodland represents the initial phase of intensive occupation in the study area. The recent investigations by Henry (1977a, 1978), Young (1978), and Farley and Keyser (1979) have provided data from a number of sites which fall within the Plains Woodland Phase.

This stage is characterized by the presence of small and large notched bifaces and grit tempered ceramics. In general, the site assemblages contain a narrow range of lithic tools (points, bifaces,

scrapers, and retouched pieces), grinding stones, and a predominance of tertiary flake elements. Variations among the sites are primarily in the density of artifacts present, and occasionally a fluctuation in the lithic tool range, an absence of grinding implements, and the presence of burnt sandstone concentrations. In most cases, however, the fluctuation in site assemblages is viewed more as a variation in temporal occupation rather than in specific site functions.

Palynological and faunal evidence recovered from the Hominy Creek Valley tentatively indicates that the sites in that area were seasonally occupied. Henry (1978:93) maintains that the evidence suggests that the occupants of Hominy Creek Valley were engaged in a central based wandering system. Farley and Keyser's work (1979:61) in the Little Caney River Valley provides similar conclusions on the basis of fluctuation of site size. Evidence from Kaw Reservoir (Young 1978) also generally falls into the same model.

The sites in Hominy Creek and Little Caney River valleys were removed from local chert sources. The lithic material recovered from each area consists primarily of Kay County and Keokuk chert. The absence of a local source of raw material and the high frequency of tertiary flakes, or the relative absence of primary and secondary flakes, suggest that the raw materials were being traded. It is then possible that the establishment of trade networks provided the necessary source of raw material required for settling into the study area.

Plains Village (A.D. 900-1500)

The traits which are commonly associated with the Plains Village occupations are an increase in small, corner-notched projectile points,

shell tempered pottery, the use of cultigens, and mound construction. However, for the study area, the pattern of subsistence appears to remain remarkably similar, with only the presence of corner-notched points and shell tempered ceramics providing a basis through which the Plains Village can be separated from the Plains Woodland.

Palynological, faunal, and geomorphological evidence suggests that an environmental shift may have occurred in the Hominy Creek Valley region at approximately A.D. 800. Henry (1978:95) concludes that "The onset of drier conditions during the ninth century A.D. does not appear to have a significant impact upon the overall subsistence strategy of the inhabitants of Hominy Creek Valley."

Summary

Based on data from work done in the surrounding areas, sites in the study area represent small seasonal occupations with generalized tool assemblages. Such sites can be called transient camps (Leehan, Duncan, Hackenberger, and Stewart 1977). The sources of the lithic raw material on these sites generally include both Kay and Keokuk, both derived from beyond the immediate area, as the primary types. Other types exist but in lower frequencies. In some sites, Kay is dominant, and in others Keokuk is.

No Archaic sites in the study region have been excavated. However, using data from excavated sites in extreme northeastern and eastern Oklahoma, these transient camps in the study area would appear to represent the foundation of the subsistence/settlement system. If no special activity sites are found in the Archaic, it may mean that the local groups are organized in an egalitarian fashion rather than in a hierarchical fashion.

On the other hand, sites deposited by Plains Woodland and Plains Village groups are most likely segments of a larger, more varied subsistence/settlement system. This would include agricultural sites, hamlets, or villages (Cheek, Cheek, Hackenberger, and Leehan 1977:382).

There is a possibility that sites deposited in the study area after the Archaic was over in most of Oklahoma were not part of an agricultural system of adaptation. They may have retained an Archaic hunting and gathering way of life on the fringe of agricultural peoples. This does not seem likely but should be considered formally in future research.

Like the Archaic sites, those of the Plains Woodland and Plains Village occupations probably represent transient camps from which faunal and floral resources were collected. However, unlike the Archaic, it is postulated that the social structure of these later groups was at least ranked. The presence of both agricultural and collecting sites in nearby areas indicates special activities in which only segments of the social group operated, rather than a movement of the entire social group within a given geographical area.

The tools found at such transient camps would tend to have less diversity than the tools at the hamlets or villages, besides being less dense, reflecting the specialized nature of the sites. However, such transient camps might be difficult to differentiate from Archaic occupations. The latter should have a more generalized tool kit. This partly depends on the length of time a site was occupied. Yellen points out that the transient camps of the Bushmen may differ radically from one another in their tool content, depending on the number of tasks that were performed. The number would naturally be limited by the time spent at the location (Yellen 1977:81).

In conclusion, it can be noted that if and when the functions of the sites in the Candy region are known, several questions will remain unanswered relating to the role of the region as a subsistence resource. It is already known that it lacks lithic materials. However, it is not known whether it was part of the core area for some group or whether it was a fringe zone exploited for seasonal resources by a group whose core area was elsewhere. It could also have been exploited by two or more groups whose home ranges overlapped in this area. Answers to these questions are beyond the scope of this project.

CHAPTER 3

GEOLOGICAL SETTING

General Geomorphology

The proposed site of Candy Lake is located at the boundary between the Eastern Sandstone Cuesta Plains and the Claremore Cuesta Plains (Curtis and Ham 1972); both are subregions of the Osage Plains subdivision of the Central Lowlands physiographic province (Thornbury 1965; Hunt 1967). The Claremore and Eastern Sandstone Cuesta Plains are characterized by Pennsylvanian strata that dip gently westward. Resistant depositional units form cuestas between plains formed on shales. The continuity of the plains is also broken by stream valleys which usually possess moderately steep valley walls.

Candy Creek (Fig. 3-1) is a mature stream possessing a well-developed floodplain. The valley bottom varies in width from approximately 1500 feet (460 m) to more than 4,000 feet (1220 m) within the proposed impoundment area. Valley walls are steep, locally rugged, and have 150-200 feet (137-183 m) relief above the floodplain in most localities. Candy Creek is incised 20-26 feet (6-8 m) into the floodplain in most localities. Further incision of the channel is inhibited by resistant bedrock outcropping within the present channel of the stream. Approximately 8.2 miles (13.2 km) of stream channel is located within the proposed impoundment area. Stream gradient averages approximately 7.9 ft/mi

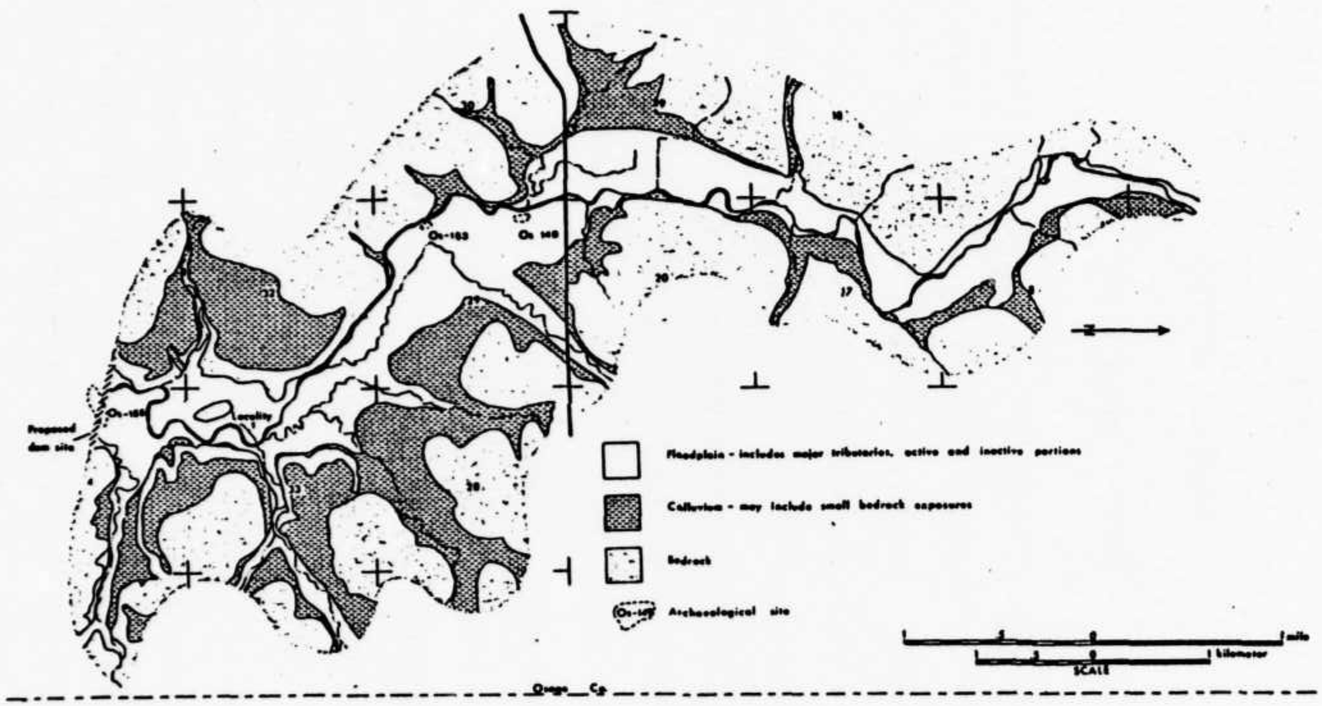


Fig. 3-1. Surficial Geology-Candy Lake Area.

(1.5 m/km), but bedrock outcrops within the channel create many local irregularities, so that gradient actually varies from as little as 4.6 feet/mile (0.86 m/km) to as much as 14.9 ft/mi (2.82 m/km).

The present course of Candy Creek meanders slightly and abandoned meanders and other fluvial erosional and depositional features indicate the nature of the stream channel immediately prior to and during the present stage of downcutting. Filled paleochannels exposed in the present channel walls indicate previous episodes of downcutting during the Holocene, some of which were of similar magnitude to that of the present erosion.

Bedrock

Exposed bedrock within the study area includes limestones and shales of the Iola Formation and sandstones and shales of the overlying Wann Formation. Both formations are of Pennsylvanian (Missourian) age. The Iola Formation (Avant Limestone, Muncie Creek Shale, and Paola Limestone) is usually present in lower portions of Candy Creek valley walls, where the Avant Limestone often forms conspicuous ledgy outcrops and small natural rockshelters. Abundant exposures of this formation occur in close proximity to Os-155 (Fig. 3-1).

The Wann Formation (Torpedo Sandstone, Clem Creek Sandstone, and unnamed intervening shale units) is mainly present in upper portions of valley walls and is usually less well-exposed than the Avant Limestone. Bedrock dips to the west and southwest in the study area. Individual formations have not been distinguished on Figure 3-1, as this was not the main purpose of this investigation.

Soils

Soils within the proposed pool area are variable in texture, color, and degree of development. Floodplain soils are mainly Mason Silt Loam, Barnsdall Very Fine Sandy Loam, Wynona Silty Clay Loam, Cleora Fine Sandy Loam, and Verdigris Silt Loam. Distinctions among the various soil types are primarily the result of differences in parent materials, vegetation, topographic position and slope, and predominant geomorphic processes during pedogenesis. Near floodplain margins, where slopes are somewhat steeper and colluviation becomes an important depositional mechanism, soils of the Coweta-Bates Complex, Steedman-Coweta Complex, and Dennis-Carytown Complex predominate.

The reader should be aware that a number of other soil types are locally present within the study area, and that the soils listed above and described in Appendix I are merely those deemed to be most important in terms of aerial extent and archeologic significance. Appendix I lists characteristics of typical profiles of each soil types or complex listed above. This information was derived from unpublished preliminary field sheets of the Osage County Soil Survey, currently being completed by the Soil Conservation Service. This information is unchanged from the preliminary field sheets, except in format.

Holocene Deposits

Previous Investigations

Until recently, detailed studies of Holocene stratigraphy were almost totally lacking in northeastern Oklahoma. A series of recent studies by Hall on Birch Creek (1977a), in the Hominy Creek Valley (1978),

and in the Copan Reservoir area (1977b) now provides a detailed partially dated Holocene stratigraphy and geomorphic history which, for the most part, applies directly to Candy Creek. Table 3-1 provides a summary of Holocene events in the Copan Reservoir area as determined by Hall (1977b:16), and Figure 3-2 is a schematic representation of Holocene stratigraphy in the same area (1977b:17).

TABLE 3-1

COMPOSITE HISTORY OF EROSION, SEDIMENTATION, AND SOIL FORMATION IN THE COPAN RESERVOIR AREA (TIME ESTIMATED) (Taken Directly from Hall 1977a)

Erosion	Entrenchment of floodplain by 6 m; virtually no lateral widening or change in channel has occurred since entrenchment; weak woil development on floodplain surface.	0-50,200 y.a.
Unit A	Deposition of alluvial unit A; top of unit forms present-day floodplain surface; deposition of unit A terminated formation of Copan floodplain paleosol; radiocarbon dated 848±62 years b.p. (SMU-365).	200-1,000 y.a.
Erosion	Entrenchment of floodplain by 3 m channel later filled by alluvial unit A; extensive sheet erosion on hillslopes.	about 1,000 y.a.
Copan Paleosol	Development of soil in floodplain; humic acids from interval 3-16 cm below top radiocarbon-dated 1,300±100 years b.p. (SMU-390).	about 1,300 y.a.
Unit B	Deposition of alluvial unit B; main valley fill in drainage basin; radiocarbon-dated 1981±75 years b.p. (SMU-357).	1,000-6,000 y.a.
Erosion	Entrenchment of floodplain by at least 4 m.	6,000-7,000 y.a.
Unit C	Deposition of alluvial unit C; accumulation of calcium carbonate at base of unit.	7,000-9,000 y.a.

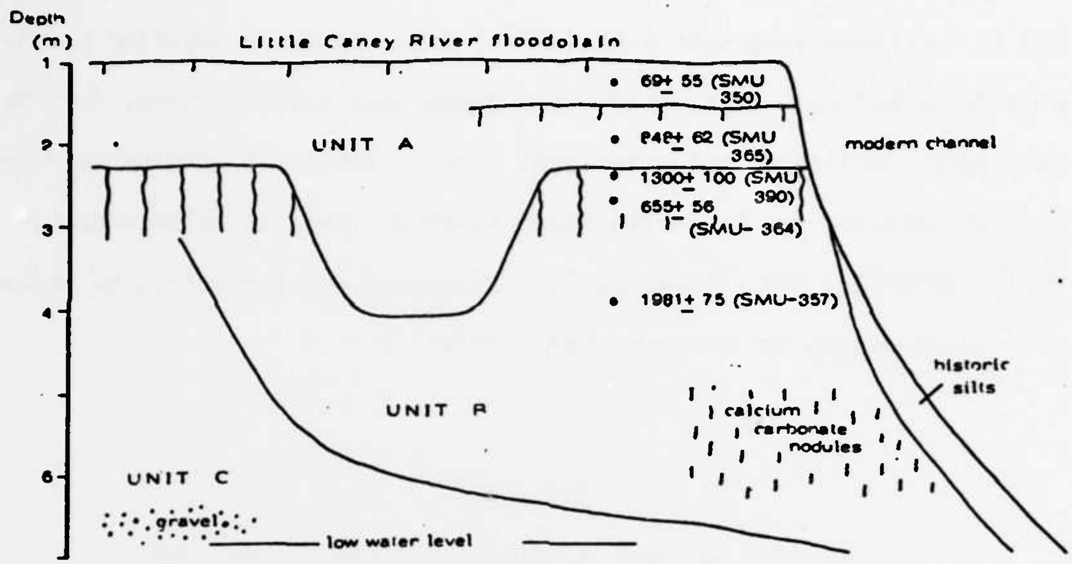


Figure 3-2. Composite Cross-Section of Little Caney Alluvial Valley (Modified from Hall, 1977b, p. 17)

This Study

A brief period of reconnaissance investigation was spent in the Candy Creek area in March of 1979 to establish stratigraphy and geomorphic relationships of archeological sites. An additional brief period was spent in August of 1979 in order to refine stratigraphic relationships of alluvial units and collect materials suitable for radiocarbon dating.

This study resulted in definition of a stratigraphic sequence almost identical to that described by Hall (Fig. 3-2, Table 3-1). Three major depositional units interrupted by periods of erosion and soil formation were identified (Fig. 3-3). In deference to Hall's terminology, depositional units have been called A, B, and C. In the

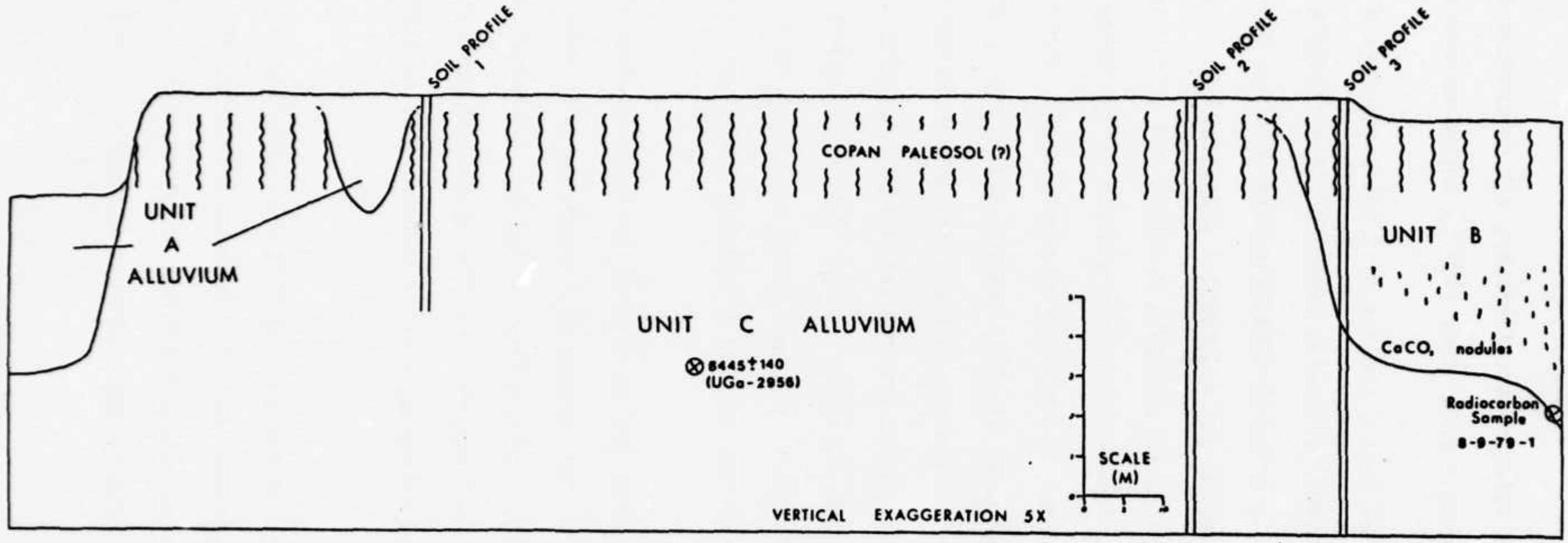


Figure 3-3. Major Depositional Units at Candy Creek

following discussion of Holocene stratigraphy, all references to Hall are from the Copan Reservoir area study (1977b) unless otherwise noted.

Unit C. Deposits of Unit C consist of a thick sequence of alluvial silts and fine sands originally deposited in a floodplain environment. Much of the original stratification has been masked by post-depositional weathering and groundwater modification. Fluctuating water tables have produced extensive mottling and oxidation throughout visible exposures. Maximum thickness visible in the Candy Creek area is approximately 9 m. In contrast to nearby areas, where Hall reported only minor exposures of silty gravels belonging to Unit C, this alluvium forms a major portion of visible stratigraphy in several areas of Candy Creek. These deposits are not dated in surrounding areas, but non-cultural charcoal from Locality 1 (Figs. 3-1, 3-3), approximately 5.5 m below the top of Unit C, has been dated at 8445 ± 140 b.p. (UGa-2956). Detailed descriptions of Unit C deposits are given in Appendix II, Profiles 1 and 2.

Pedogenic modification has so altered the upper surface of Unit C that the exact nature of the contact with overlying sediments cannot be determined in most areas. In Locality 1, however, a channel was deeply incised into Unit C. Hall reports a similar period of downcutting in the Copan Reservoir and estimates time of entrenchment at 6,000-7,000 b.p.

Unit B. The paleochannel cutting Unit C at Locality 1 is filled with alluvium of depositional Unit B. Lowermost deposits are typical channel facies gravels and sands (Appendix II, Profile 3). The deposits gradually fine upward, and uppermost sediments of Unit B are

floodplain silts and fine sands. Alluvium of this unit is also mottled, although generally not to the extent of Unit C. Very strong oxidation is locally present near the bottom of the former channel, particularly in coarse-grained beds and lenses. Calcium carbonate accumulation is prominent in the lower part of the channel fill and small (1-5 mm) $CaCO_3$ nodules are locally present.

Hall estimates that deposition of Unit B sediments occurred between 1,000 and 6,000 years ago. A large charcoal sample was collected from lowermost channel deposits at Locality 1 which should date the beginning of deposition of Unit B sediments and will provide a minimum date for the erosion cutting Unit C deposits. Unfortunately, C^{14} analysis of materials from cultural contexts had not been completed at the time of this writing (August, 1979), although dates of some materials from non-cultural contexts are included here.

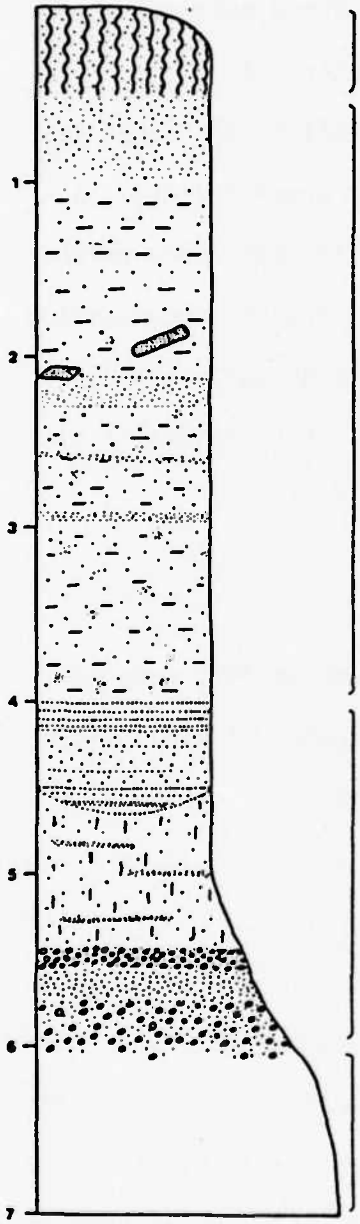
Copan Paleosol. Hall reports the presence of a strong soil A-horizon developed on Unit B alluvium (1977a, b, 1978). Although deeply buried A-horizons were not seen in the Candy Lake area, a prominent red, argillaceous B-horizon is developed on Unit B alluvium and eroded (?) surfaces of Unit C. Several manifestations of the paleosol are described in Appendix II, Profile 1 (43-218 cm), Profile 2 (30-250 cm), and Profile 3 (35-226 cm). Although absent in many areas, this paleosol forms a convenient marker horizon where present. Silt flour and other evidence of leaching in the lower part of the A-horizon forming the surface at Locality 1 may indicate pervasive destruction of a Copan A-horizon by more modern pedogenesis, but evidence for this is inconclusive.

The Copan Paleosol was dated by Hall at 1,300 ± 100 b.p. No dateable materials were obtained from the paleosol in Candy Creek, but the degree of development of peds and clay films suggests to me that the soil may have begun forming prior to 1300 b.p. As more data are collected on this paleosol it may become possible to demonstrate that the soil began forming much earlier near floodplain margins where deposition and erosion was minimal and began forming progressively later toward the center of the valleys.

The paleosol has been truncated by a small channel in Locality 1. Hall reports a similar episode of channel-cutting in the Copan Reservoir area. The channel is undated.

<u>Unit A</u>. Deposits of Unit A channel-fill alluvium form "terraces" along Candy Creek and several larger tributaries. Additionally, thin, pedogenically modified Unit A sediments are believed to form the surface of the floodplain in some areas in the Candy Creek basin. Sediments of Unit A are extremely variable in nature, ranging from strongly oxidized channel gravels, organic-rich paludal deposits, fine-coarse sands to silts and silty clays. A typical profile of the channel and channel-marginal facies sediments is shown in Figure 3-4. Floodplain deposits of Unit A are usually thin (less than 1 m) and commonly are so modified by pedogenesis that little of the original nature of the deposits can be ascertained. Typical profiles of soils developed on these sediments are described in Appendix II, Os-155 Excavation areas 1, 2, and 3.

Hall reports a date of 848 ± 62 b.p. from Unit A on the Little Caney River (Fig. 3-2). A date of A.D. 315 ± 165 b.p. (UGa-2855) was obtained from channel-marginal, non-cultural deposits in Candy Creek. Dating of



A-horizon organic accumulation. Varies from 0-40 cm in thickness due to erosion.

Silty yellowish floodplain deposits. Brownish zones are occasionally present, which may represent minor A-horizon development. Lower two meters are mottled. Occasional red oxidized sandstone subangular cobbles are present.

Alternating thin-bedded sands and silty or fine sandy paludal deposits in upper part. Oxidation on bedding planes. Lower portion sandy organic-rich paludal sediments. Occasional charcoal flecks near 5 m. Overlies highly oxidized pebble gravels and sand.

Covered.

Figure 3-4. Typical Channel-fill Unit A Alluvial Deposits in Candy Creek Area. Profile located in SW¼, NW¼, Sec. 29.

nut fragments and charcoal associated with Os-155 has yet to be completed, but should date near the beginning of deposition of Unit A floodplain sediments. (Editor's note: Dates on these cultural materials obtained in late 1979 are considered in Chapter 9.)

A "second floodplain paleosol" reported by Hall in the Copan Reservoir area (p. 19) was not observed in the Candy Creek drainage, although minor organically stained zones were seen in some areas which might represent incipient A-horizon development. Organic accumulation and initial stages of A-horizon development can occur quite rapidly, so that thin incipient "A-horizons" are probably not geologically significant, nor likely to have large aerial extents.

Archeological Sites

Three archeological sties, Os-149, Os-153, and Os-155, were examined during this investigation (Fig. 3-1). A number of similarities were noted in all the sites. All the sites were located in broad portions of the floodplain near the confluence with a major tributary, and each site was located in close proximity to Candy Creek. All the sites appear to overlie sediments of alluvial Unit B, being in Unit A sediments or pedogenically modified uppermost Unit B deposits. Distribution of artifacts in all sites appears to have been modified to some extent by post-depositional bioturbation. The sites are briefly described below. In the absence of radiocarbon dates and diagnostic stratigraphic association, all postulated ages of sites must be assumed tentative.

Os-149

The site is located on the floodplain near the present edge of Candy

Creek. A small "terrace" composed of Unit A sediments is present along the edge of the creek approximately 1-1½ m below the floodplain surface. Lithic debris is also found on and in Unit A sediments, although not in concentrations suggestive of a site (Fig. 3-4). Redeposition must be considered a possibility for these materials.

Depositional stratigraphy cannot be determined in this site. A weak A-horizon is present on the floodplain surface, and it appears that much of the surface may have been removed or modified by erosion and plowing. It appears that the site is located on top of Unit B alluvium, and that the upper portion of the site has been altered by erosion and plowing. I would estimate the site age to be circa 1,500 - 500 years b.p.

Os-153

The site is located on the contact of the floodplain and a small "terrace" composed of Unit A alluvium. The floodplain surface is composed of fine loamy sands, with little apparent evidence of pedogenic modification of the deposits. A-horizon soil organic accumulation has apparently been removed by erosion and plowing over most of the floodplain surface in this area.

An initial appraisal led me to believe that the floodplain surface was composed of Unit A sediments and that a paleosol corresponding to the Copan Paleosol should be encountered at depth beneath the sandy deposits. Auguring below the floor of excavation areas located on the floodplain revealed no such paleosol, however. A weak B-horizon is encountered below an A-horizon in pit ER-2, but is not similar in degree of development to B-horizons described in Locality 1.

The site has been extensively eroded in upper portions. Estimated age of the site is 1,500 to 300 years b.p.

Os-155

This site is located on the floodplain across the proposed axis of Candy Lake Dam (Fig. 3-1). This site appears to consist of a broad group of lithic concentrations just below the modern surface. Three separate areas of the site were opened and detailed descriptions of each area is presented in Appendix II. Each of the excavations stopped at or near the upper surface of a hard B-horizon which showed signs of clay translocation, although pervasive oxidation was not seen in any of the profiles. In each excavation area archeologic content disappeared or dwindled markedly below the A-horizon.

Stratigraphy in the excavation areas and nearby channel exposures suggests that the surface of the floodplain at this locality is composed of a thin layer of Unit A alluvium and that the occupation was concomitant to deposition of this alluvial unit. The B-horizon is believed to correspond to the Copan Paleosol.

Excavation areas were initially located by lithic concentrations being eroded from the sides of several broad, shallow channels cut into the floodplain surface. These channels are believed to pre-date channel-fill Unit A alluvial deposits in nearby Candy Creek. A radiocarbon sample (UGa-2855) from these deposits yielded a date of 315 $\pm$ 165 b.p. The sites were already buried at the time of channel entrenchment on the floodplain and certainly pre-date the dated Unit A deposits. Assuming correlations with Hall's stratigraphic sequence to be correct,

the sites should be no older than 1981 $\pm$ 75 b.p. and no younger than 315 $\pm$ 165 b.p. The humic-acid date of 1330 $\pm$ 100 from the Copan Paleosol was not used, as this date should be considered a minimum date of the paleosol. In my estimation, the site is probably between 2,000 and 1,000 years in age.

Conclusions

Stratigraphic associations, geomorpnologic relationships, and available dates from the Candy Creek area strongly support Hall's proposed chronology for northeastern Oklahoma. Indeed, the sequence of Holocene events in the Candy Creek area appears to be almost identical to that proposed by Hall (Table I, Figure 3-2).

Geological studies in association with archeological investigation of this type can reveal a great deal of information regarding site-geomorphologic relationships, resource bases of the past, and integrity of sites. In most instances, however, stratigraphic relationships allow initial age estimation of sites only at a gross level of accuracy in this area.

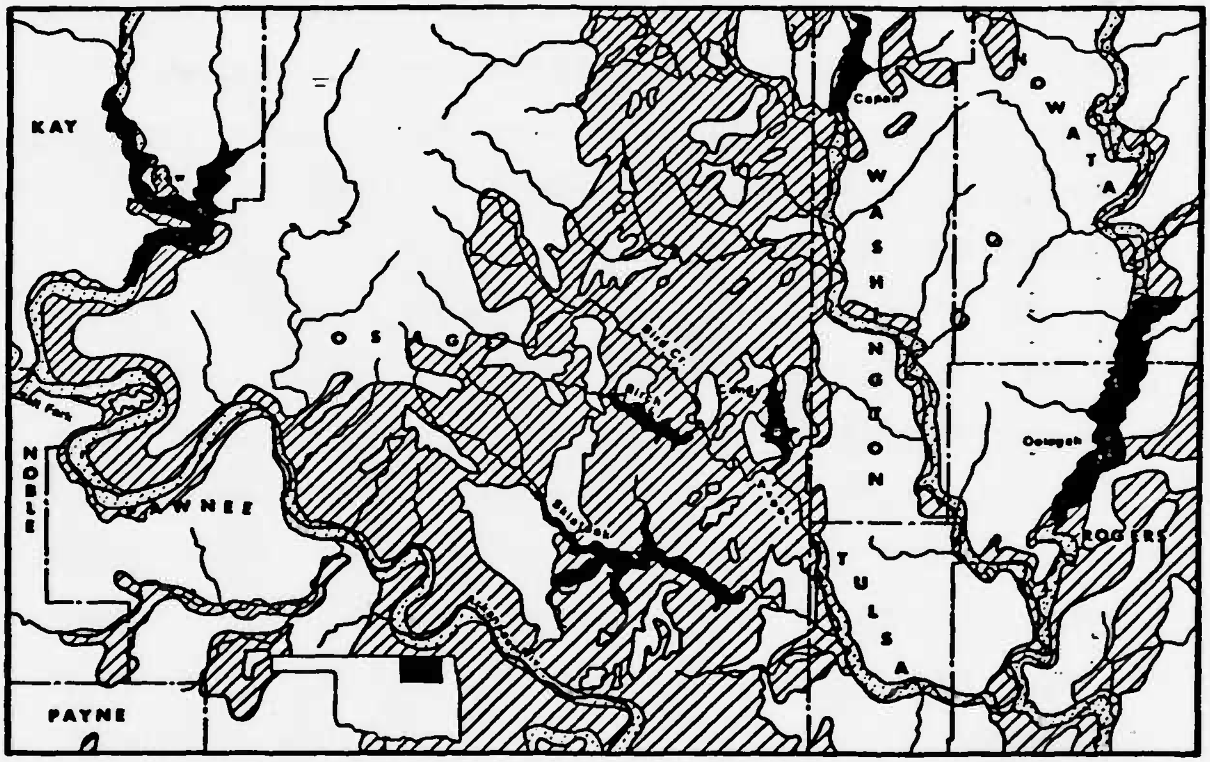
CHAPTER 4

ENVIRONMENTAL SETTING

Candy Lake is in the eastern portion of Osage County within the Verdigris River basin. The creek lies within a geomorphic provence known as the Eastern Sandstone Cuesta Plains (Curtis and Ham 1972). This provence is characterized by west dipping Pennsylvanian sandstone and limestone that form cuestas which overlook broad shale plains.

The area receives an average rainfall of 36 inches (914 millimeters) a year and has a mean annual temperature of 60 degrees Fahrenheit (15.5° Centigrade). The yearly average temperature range is 25 degrees (-4°C) to 95 degrees (35°C) with extremes of 25 degrees below zero (-32°C) and 115 degrees Fahrenheit (46°C). On the average, temperatures are below freezing 90 to 100 days annually. The majority of precipitation falls during the spring and early summer, with winter being the driest season (Oklahoma Water Resources Board 1971).

Bruner (1931) classified this portion of northern Oklahoma as an oak-hickory savannah, which consists of grasslands alternating with areas of open woodland. Duck and Fletcher (1943, 1945), in their statewide study of "game types" and associated plant communities, recognized two major plant communities in the Candy Creek Area (Figure 4-1). The first was the tall grass prairie and the second was the post oak-blackjack oak forest. A third, the bottomland forest, certainly occurs in the Candy Creek floodplain, although on a scale too small to be included on Duck and Fletcher's state map.



BOTTOMLAND FOREST
POST OAK BLACKJACK
TALL GRASS PRAIRIE

ENVIRONMENTAL ZONES
NORTHCENTRAL OKLAHOMA

FIGURE 4-1

The post oak-blackjack oak forest's dominant plants include species characteristic of deciduous forest and grasslands. The overstory is composed largely of post oak (Quercus stellata), blackjack oak (Q. marilandica), and black hickory (Carya texana). The understory is made up of little bluestem (Andropogon scoparius), big bluestem (A. gerardii), and various other species. In terms of edible foods the post oak-blackjack oak forest could have supplied both acorns and hickory nuts as well as cottontail rabbit (Sylvilagus floridanus), white-tail deer (Odocoileus virginianus), fox squirrel (Sciurus niger), and possibly elk (Cervus canadensis) in prehistoric times (Duck and Fletcher 1945:21).

The tall grass prairie is characterized by a lack of trees and dominated by such species as big bluestem, little bluestem, Indian grass (Sorghastrum nutans), and switch grass (Panicum virgatum). Before the tall grass prairies were settled by Americans common wildlife consisted of prairie dog (Cynomys sp.), jack rabbit (Lepus sp.), badger (Taxidia taxus), striped skunk (Mephitis mephitis), prairie chicken (Tympanuchus cupido), bison (Bison bison), coyote (Canis latrans), and a variety of small rodents, reptiles, birds, and invertebrates (Duck and Fletcher 1945:28-29). In the past, obviously the bison was the most important faunal resource in the grasslands but a variety of small animals and a few plants such as sunflower (Helianthus spp.), prickly pear (Opuntia spp.), and Indian turnip (Psoralea escalenta) could have provided valuable additions to the diets of hunter-gatherers.

The bottomland plant community occurs along Candy Creek floodplain and its tributaries. The dominant plants in this community include American elm (Ulmus americana), chinquapin oak (Quercus muehlenbergii),

western hackberry (Celtis occidentalis), chittum wood (Bumelia langinosa), Chickasaw plum (Prunus angustifolia), sumac (Rhus spp.), rough-leafed dogwood (Cornus drummondii), and coralberry (Symphoricarpos orbiculatus). The community supports a large variety of animals today such as quail (Colinus virginianus), fox squirrel, grey squirrel (Sciurus carolinensis), deer, cottontail rabbit, raccoon (Procyon lotor), opossum (Didelphis marsupialis), striped skunk, spotted skunk (Spilogule putorius), mink (Mustela vison), muskrat (Ondatra zibethicus), and beaver (Castor canadensis) (Duck and Fletcher 1945:23, 26).

The greatest variety of food resources occurs in the bottomland plant community. Plant food resources include acorns, plums, pecans (Carya illinoensis), hackberries, wild grapes (Vitis sp.), and various roots such as greenbriar (Smilax spp.), bulrush (Scirpus sp.), cattail (Typha sp.), and arrowhead (Saggitaria latifolia). Probably the most important animal food resource in the past would have been deer, but rabbits, squirrels, opossums, raccoons, skunks, and various rodents may have been utilized also. In addition, the streams offer various species of fish, mussels, and crayfish.

All three archeological sites, Os-149, Os-153, and Os-155, reported in this monograph are within or would have been within the bottomland plant community, but access to either of the other two plant communities would have been easy, as well as to the Candy Creek streambed. It seems likely that prehistoric hunter-gatherers could and did exploit all these areas for food and other types of resources.

CHAPTER 5

PREVIOUS FIELDWORK

Candy Creek Survey

The proposed Candy Lake was surveyed by Cheek and Wilcox (1974) in 1973. Their investigations located 11 historic and pre-historic sites (Figure 5-1). The authors' initial observations noted that a variety of subsistence activites were contained within the reservoir area and that, apparently, Kay County chert represented the predominate raw material utilized for the lithic technologies. Eight pre-historic sites were recommended for further testing. These recommendations were largely determined by the lack of recorded sites in northeast Oklahoma; consequently, the authors suggested that the Candy Creek sites would provide information for developing a chronological sequence of prehistoric activities within northeastern Oklahoma. They also maintained that the variety of sites possibly contained the necessary information for constructing the subsistence patterns of the previous inhabitants. Sites Os-147, 149, 151, 153, 154, 155, 157, and 158 were recommended for sub-surface testing.

1976 Excavations

In 1976, Leehan, Duncan, Hackenberger, and Stewart (1977) tested sites Os-147, 151, 154, 155, 157, and 158. Sites Os-149 and 153 had been slated for testing as well, but due to a conflict with the

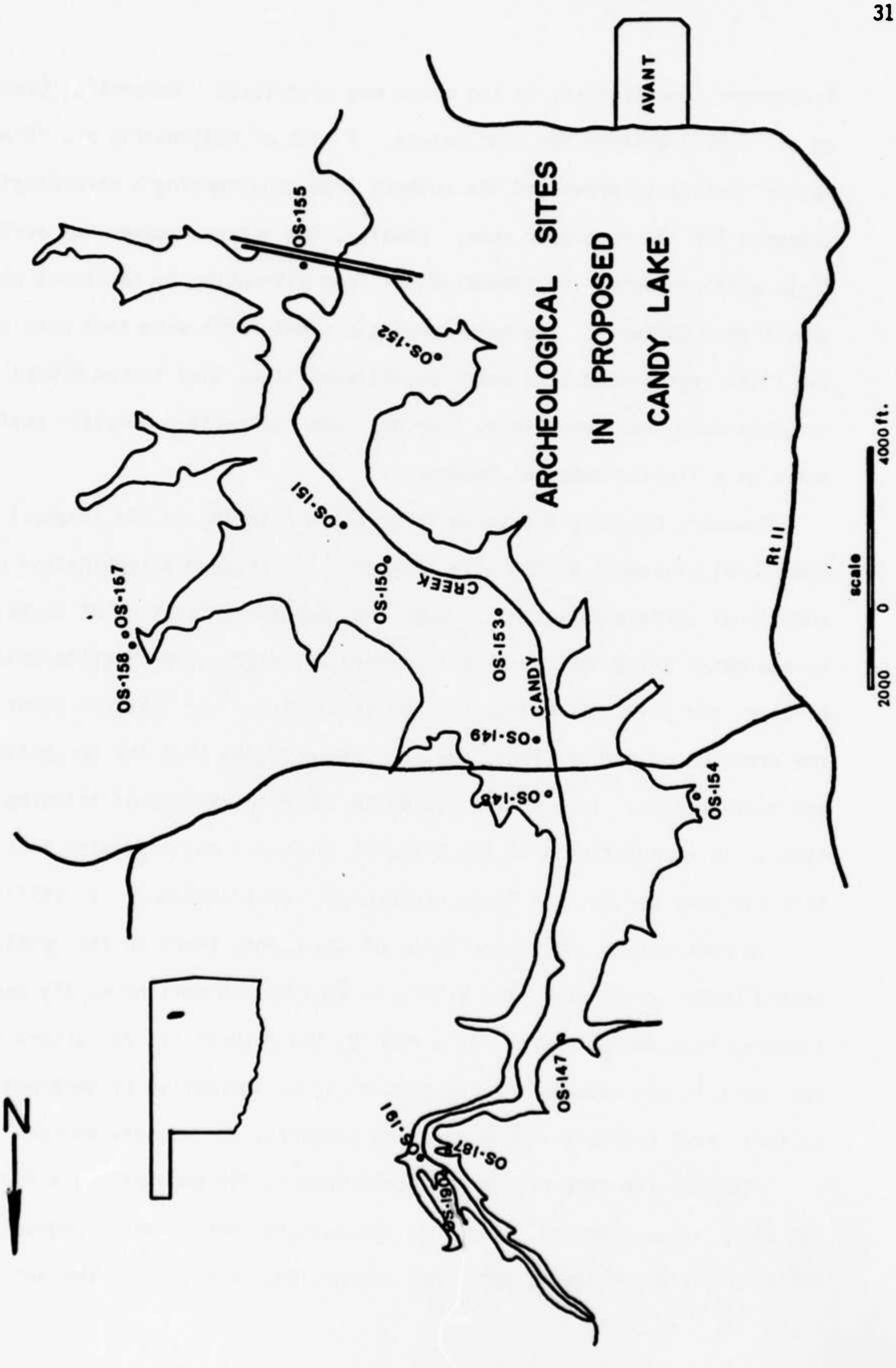

ARCHEOLOGICAL SITES
IN PROPOSED
CANDY LAKE
AVANT
Rt 11
scale
2000
0
4000 ft.
CANDY
CREEK
N
OS-147
OS-148
OS-149
OS-150
OS-151
OS-152
OS-153
OS-154
OS-155
OS-157
OS-158
OS-187
OS-190
OS-191

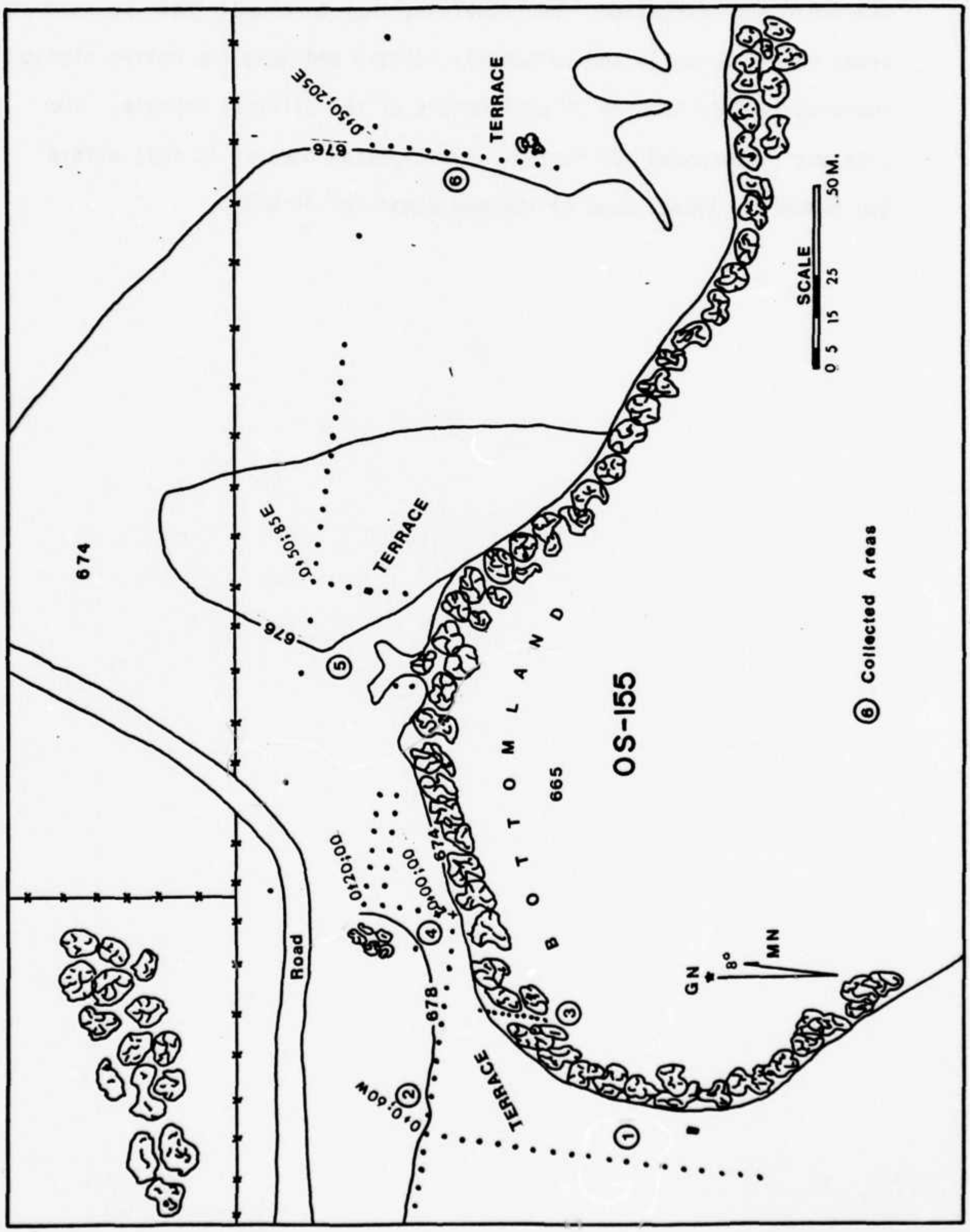
FIGURE 5-1

landowners accessibility to the sites was restricted. Generally, Leehan et al. (1977) offered few conclusions. A lack of radiometric and "diagnostic" artifacts prevented the authors from constructing a chronological sequence for the reservoir area. Equally, the sparse recovery of artifacts also prevented the investigators from attempting to construct past subsistence patterns. The only conclusions set forth were that none of the sites represented base camps or villages since they lacked midden accumulations; so, conversely, they may have represented specific activity areas of a limited temporal nature.

However, Os-155 did contain information relating to the temporal and functional placement of the site (Figure 5-2). Through a combination of additional surface collections, augering, and the excavation of seven one-by-one meter units, the authors recovered a variety of projectile points, bifaces, and grinding implements. On the basis of one Scallorn point and the presence of ground stone, the authors concluded that the occupation was post-archaic. In addition, based on the predominance of thinning flakes, in conjunction with the bifacial tools, it was suggested that the site may have served as a "game procurement" area (Leehan et al. 1977:53).

In contrast to the predominance of Kay County chert in the remaining tested Candy Creek sites, the artifacts from Os-155 were primarily manufactured from Keokuk chert. As a result, the authors (p. 23) argued that the shift in raw material procurement might be indicative of separate cultural traditions, variance in trade networks, or temporal change.

Although the recovery of artifacts from Os-155 encompassed a 400 by 200 meter area, Leehan believed that the cultural debris was a product of either a series of short, temporary occupations or scattered remnants of



OS-155
BOTTOMLAND
TERRACE
TERRACE
TERRACE
Road
674
676
676
678
674
665
D150:205E
D50:85E
0:20:00
0:00:00
0:0:60W
1
2
3
4
5
6
GN
MN
8°
SCALE
0 5 15 25 50 M.
6 Collected Areas

FIGURE 5-2

one prolonged occupation. Nevertheless, they concluded that the separate areas were temporally and culturally related and that the entire site was contained within the top 30 centimeters of the alluvial deposit. The site was recommended for further investigation because it fell within the immediate impact zone of the dam construction site.

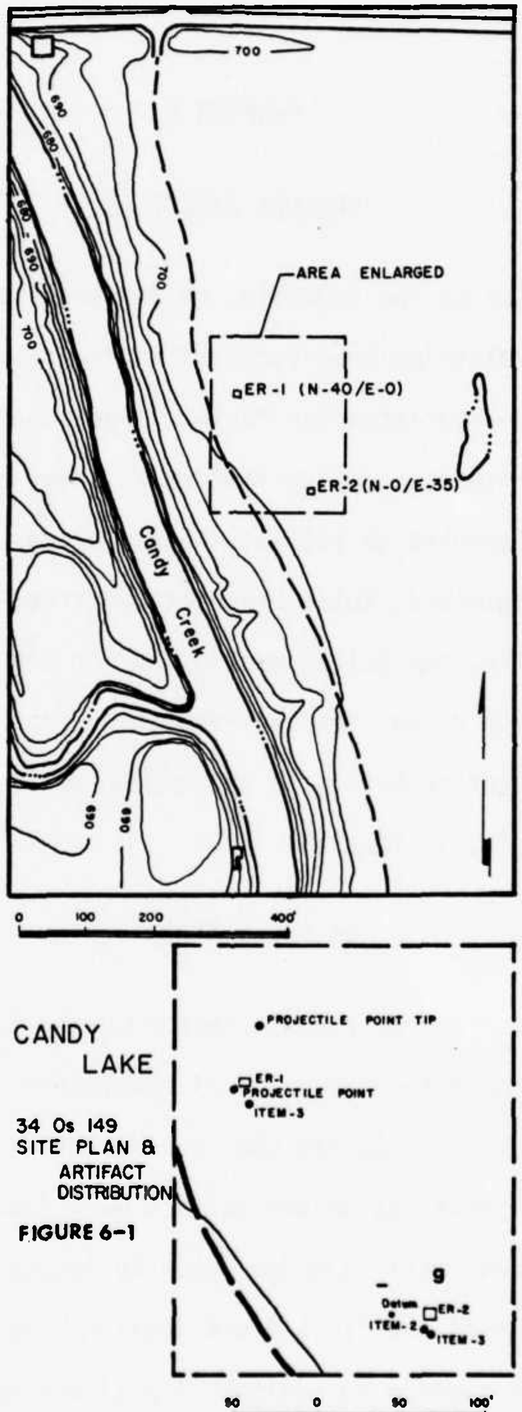
CHAPTER 6

PRESENT FIELDWORK

Shortly prior to the beginning of construction activities at Candy Lake, the Tulsa District Army Corps of Engineers contracted with Archeological Research Associates for further investigation at Os-149, 153, and 155. The winter and spring fieldwork, under the direction of Daniel Crouch, was implemented to fulfill the guidelines set forth in the U.S. Army Corps of Engineers, Tulsa District, contract number DACW56-79-C-0040. Essentially, the guidelines called for the excavations of Os-149, Os-153, and Os-155 using standard excavation techniques, with an emphasis upon collecting artifacts and pollen, soil, carbon 14, faunal, and flotation analysis, if feasible.

Os-149 and Os-153

Dan Crouch served as field director during this first phase of work. The strategy used in the selection of excavation locations at Os-149 and Os-153 (Figures 6-1 and 6-2) was similar for both sites. The first step was to mark all artifacts on the surface with flagging tape. As many of the artifacts were small, care was taken to locate as many as possible. During the course of the first field session rains exposed more and more artifacts on the surface so additional artifact concentrations were discovered and mapped during the course of excavations.



CANDY LAKE

34 Os 149
SITE PLAN &
ARTIFACT
DISTRIBUTION

FIGURE 6-1

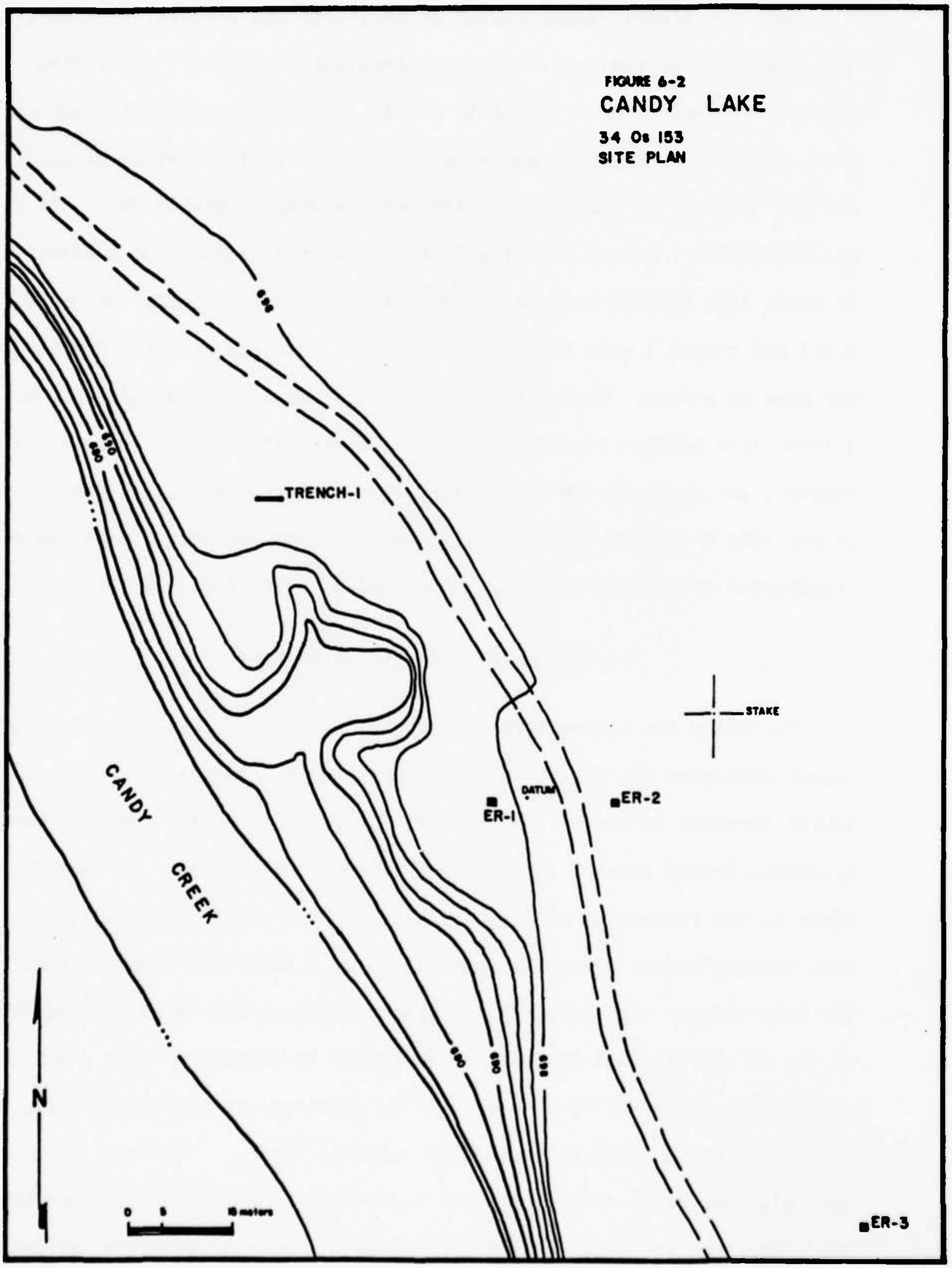


FIGURE 6-2
CANDY LAKE
34 Os 153
SITE PLAN
TRENCH-1
STAKE
DATUM
ER-1
ER-2
ER-3
CANDY CREEK
N
0 5 10 meters

Once the general distribution of artifacts was visible, test pits were placed in or near artifact concentrations in hopes of recovering maximum artifact samples. At both Os-149 and Os-153 very small samples were recovered in the pits excavated. This fact, plus obvious historical disturbances (a trench in Os-149 ER 2; plowing in Os-149 ERs 1 and 2, and Os-153 ERs 2 and 3) led Crouch to attempt the recovery of artifacts in areas that had not suffered from historical disturbances. At Os-153 pit 1 and trench 1 were both placed in areas that had not been plowed nor used as a road. At Os-149 pit 3 (southernmost pit) was placed along a fence line between two plowed fields and near an artifact concentration. However, the above change in strategy did not increase the artifact recovery rate at either site. In all, three one-by-one meter units and a trench were excavated at Os-153; three one-by-ones at Os-149.

Os-155 Winter-Spring Excavations

Following the same general strategies outlined for Os-149 and 153, Crouch excavated six one-by-one meter units within the three upper alluvial terraces of Os-155 (Figure 6-3). In contrast to the previous work by Leehan, Crouch located two separate occupational levels. The western (Area I) and eastern (Area III) extensions of the site contained artifact concentrations occurring approximately 50 to 80 cms below surface. The intermediate area (Area II) contained cultural debris within the top 40 cms of the alluvial deposit (as indicated by Leehan). Crouch concluded that Os-155 contained three horizontally distinct occupations possibly representing two vertically distinct cultural levels. Crouch's field work also indicated that faunal and radiometric data were available within the site area, and could possible provide an adequate basis for inferring the function and determining the age of the cultural levels.

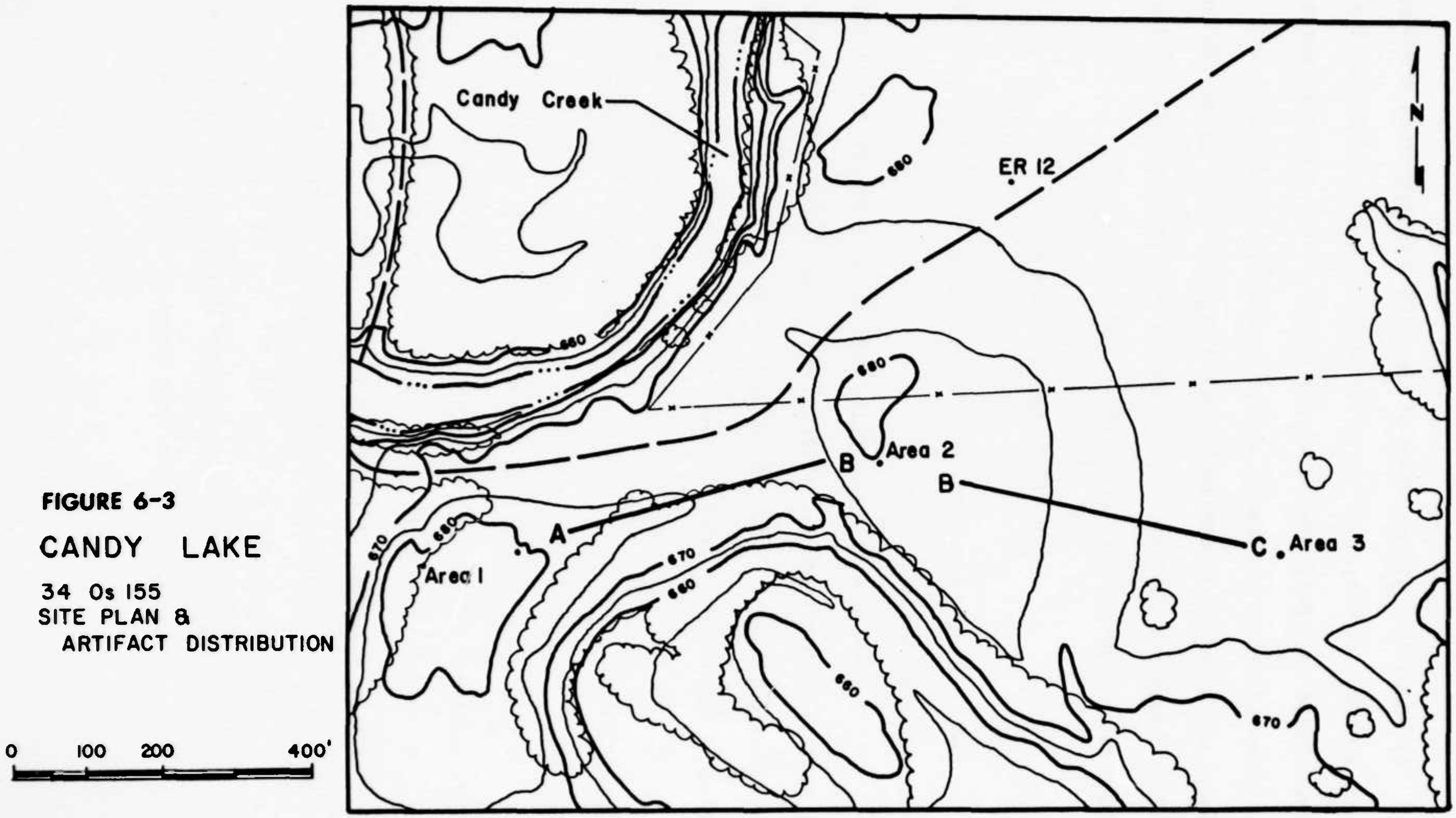


FIGURE 6-3

CANDY LAKE

34 Os 155
SITE PLAN &
ARTIFACT DISTRIBUTION

Although the initial phase of the 1979 investigations provided a more accurate portrayal of the cultural occupations at Os-155, the work also raised many questions about the nature of the site that needed to be answered before statements about the occupations could be made. The Corps of Engineers funded additional mitigation work during the summer of 1979 in order to confirm Crouch's conclusions and to obtain furthur temporal and functional information on the site.

Os-155 Summer Fieldwork

The goals of the additional fieldwork, as set forth in the 1979 contract modifications, were to

1. Investigate possible individual occupations or activity loci suggested by the irregular distribution of artifacts through horizontal and vertical space. This will be approached by excavating contiguous squares forming large areas in two or possibly three areas of the site.

2. Recover large artifact samples to reduce the possible effects of sampling bias in the analysis of raw material utilization, temporal change, and other types of analysis.

3. Retrieve larger faunal samples which will allow a more accurate assessment of site functions and subsistence systems.

4. Recover enough charcoal for direct dating of the occupations.

The second phase of fieldwork was continued under the direction of Joseph Saunders, and was guided by several research goals:

1. Physical Nature of the Site

    A. Are the artifact concentrations parts of one continuous occupation or are they three separate occupations?

B. What is the temporal relationship among both the horizontal and vertical artifact concentrations?

C. What were the geomorphological processes that formed the site?

2. Cultural Nature of the Site

A. Could the functions of the site areas be defined?

B. Did they belong to the same or different cultural traditions?

3. Relation of the Site to the Surrounding Area

A. What is the role of the site (or sites) in the subsistence/settlement system?

B. If there are changes in subsistence patterns, are they related to Hall's climatological change defined for the area?

Accepting the above, the principal strategy exercised during the second phase of the 1979 research was to acquire an enlarged sample from each of the respective areas. It was maintained that the procurement of additional artifacts would provide sufficient data for comparing the relative frequencies of raw material types, and functional and morphological attributes of artifacts from each area.

The results of such a comparative approach should allow one to estimate if similar activities had occurred throughout the site despite the spatio-temporal variability. On the other hand, if significant variations of artifact assemblages did exist, this might indicate that a shift in subsistence strategies and site utilization occurred through time. Certainly one of the foremost considerations would be, can the change be attributed to the environmental shift suggested by Hall (<u>in</u> Henry 1978)?

Initially, the immediate areas surrounding Crouch's test units were expanded. Contiguous units were excavated to gain a further understanding of the vertical and horizontal distribution of the cultural debris. The placement of subsequent units was determined by the artifact density of each successively completed unit. In effect, the placement of units attempted to follow the distribution of the heaviest area of occupation.

The disadvantages of such an approach are that, considering the temporal limitations on excavating a site, it works against being able to define adequately the lateral dimensions of a cultural deposit. Secondly, it also reduces the chances of determining if the observed area of occupation represents a single activity area or only a specialized area of a more extensive habitational zone. Therefore, to guard against such a limited perspective, once the contiguous units had been completed, attention was shifted toward defining the horizontal limits of the artifact deposits by placing units one or two meters from the central area of excavation. Units excavated are shown in Figure 6-4.

The excavation strategy in Area II represented an exception to the above. A concentration of sandstone was located at 18 to 20 cms below surface in ER 14. Since this represented the only cultural anomalie, or feature, observed on the entire site, attention was focused on exposing the horizontal distribution and overall configuration of the material.

Finally, toward the end of the summer field season, although charcoal flecks, sandstone fragments, lithic heat spalls, and burnt bone had been recovered in all three areas, not one indication of a fire hearth had been detected.

In order to determine if this lack of evidence was a product of the excavation procedures, lack of empirical evidence, or possibly an

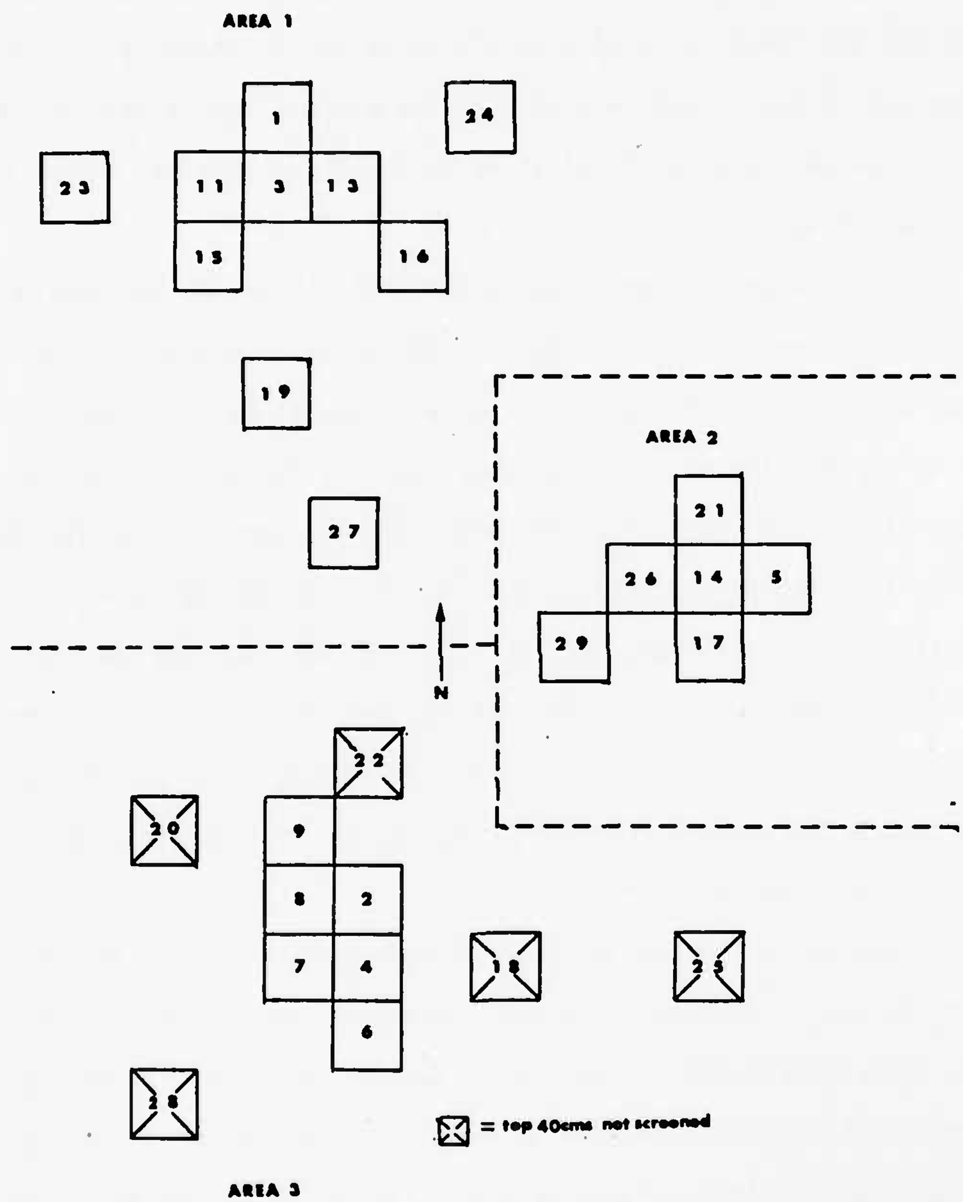


Figure 6-4. 34 Os-155 Excavated Units

actual absence of fire hearths, an experimental hearth circled with sandstone from the surrounding area was constructed in ER 29 (floor= 50 cms BS) and fired for approximately three hours (Figure 6-5). The purpose was to see if the heat of the fire would create a discoloration in the alluvium/clayey soil--if it would leave any physical evidence of having been heated.

Six weeks after the experiment, the author returned to examine the physical evidence. Except for three small areas of orange discoloration beneath the ring of sandstone, which appeared to have been produced by the heating of the sandstone, the soil did not display any visible signs of discoloration (Figure 6-6). In addition, unlike the experimental results produced by John House on quartzite gravels and chert (in Shiffer and House 1975:75-80), the sandstone did not display any visible signs of having undergone any serious fracturing. Although the amount of time the hearth was heated was rather limited, it suggests that little empirical evidence may remain to indicate that soils have been subjected to heating.

Besides the collection of larger samples of lithics, other data were collected: radiocarbon samples, geomorphological data, and a larger faunal collection. Radiocarbon samples were taken from each area of Os-155 and from a number of points in the soil profiles, and were submitted to the Southern Methodist University Laboratory. The geomorphological analysis was undertaken by Dr. Fred Niles, who was to examine the possibility that the geomorphological processes at work in the Candy Creek Valley were the same as those defined by Hall for the area to the southwest and northwest. He was also to relate the processes to the different areas at Os-155. Unfortunately, Niles left the country to work on another project before he could aid in the evaluation of the radiocarbon dates.

a. Hearth Before Firing

b. Hearth After Firing

Figure 6-5. Experimental Hearth

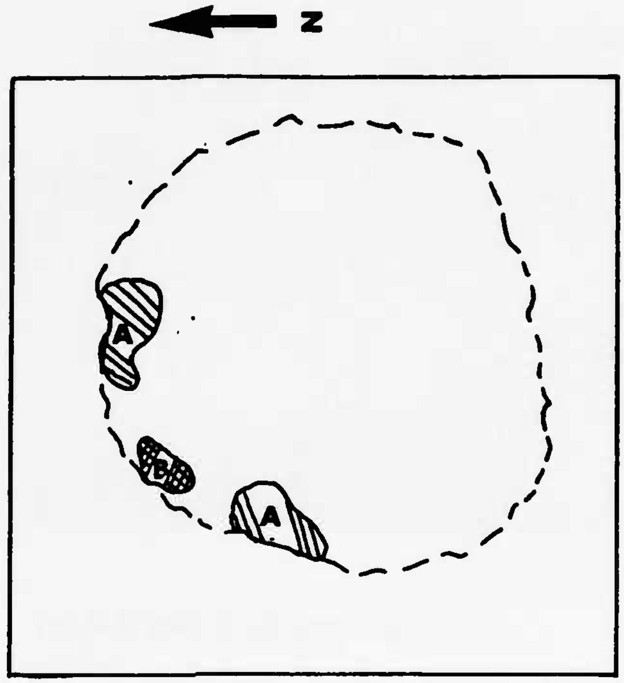


FIGURE 6-6
Experimental Hearth

A = Orange Stain
B = Red Orange Stain

1- METER

CHAPTER 7

FIELD METHODS

In that the field work conducted by the author during the summer field season primarily represents an extension of Crouch's work, the following comments apply equally to Os-149, 153, and 159. Specific variations will be noted.

Crouch established a north-south, east-west baseline on each site (he reestablished the grid system employed by Leehan on Os-155). Units were numbered by their serial order of excavation. Following the techniques outlined by Noel Hume (1968), each unit was referred to as Excavation Record (ER) 1, 2, and so on.

An arbitrary datum was established and assigned an arbitrary elevation of 100.00 meters. This was used for controlling the vertical provenience of all excavated units.

In that natural levels were not isolated within any of the tested sites during excavation, all units were excavated in either five or ten centimeter levels. The designation of the descending ten centimeter levels was alphabetical (A, B, C, etc.) with five centimeter levels receiving an alpha numeric designation (A_1, A_2, etc.).

Initially, the elevations of the corners of each unit were read with a transit and tied into the arbitrary datum elevation. Uniform vertical control was provided throughout the site by excavating levels to the nearest ten centimeter increment. For example, if the lowest

corner of a unit had an elevation of 99.93 meters, the first level would be three centimeters, thereby placing the remaining levels within ten centimeter intervals of the arbitrary datum. Once the initial level had been calibrated, vertical control was retained through the remaining levels with the use of a brick masons' level and metric tape. The test units were one-by-one meters.

Varying field techniques were practiced by Crouch in an attempt to determine the types of empirical data contained within the sites as well as to evaluate the most expedient means of data recovery.

At Os-149 and 153, alternate levels were screened through 1/4" and 1/32" screen. If cultural materials were observed in the screened materials, subsequent levels were water screened with 1/32" screen. At Os-155 upper levels were screened through 1/4" screen to expedite the excavation. As soon as cultural materials were observed, 1/32" screen was used by Crouch. Examination of the refuse indicated that micro faunal and floral remains were absent in the three sites. The variance in the recovery of lithic materials between those levels which had been 1/4" dry screened with the levels which had been water screened was not significant. Also, the logistics involved in water screening weighed against the continuation of such a procedure. Subsequently, all the Os-155 units excavated during the summer session were dry screened through 1/4" screen. Excavation of the units was facilitated with the aid of flat shovels and trowels.

Items recovered during the course of the 1979 research were collected and bagged by level. Upon arrival at the laboratory facilities, they were washed and labeled by unit and level. When a level was completed, a level/unit form was recorded noting the types and number of artifacts

recovered. Drawings of any discernible features and the listing of photographs were recorded on the unit/level forms--if applicable. North-south and east-west soil profiles were drawn for each unit and/or area.

Os-155 Summer Session

In an attempt to gain a further understanding of the vertical distribution of artifacts in Areas I and III, portions of one unit from each area were excavated by trowel only. All artifacts encountered were plotted according to their vertical and horizontal positioning.

Due to the low recovery of artifacts in the top 40 cms of the first six units excavated in Area III, subsequent work removed the first four levels without the aid of screening. Accidentally, the first two levels of ER 16 in Area I also were not screened.

A total of 28 one-by-one meter units were excavated to varying depths. The termination of any given unit was dictated by the amount, if any, of cultural materials recovered and by the properties of the soils. Although the units excavated are numbered 1 through 29, unit ten was not excavated, thereby explaining the discrepancy between the numerical listing and the actual number of units involved in the research.

CHAPTER 8

LABORATORY PROCEDURES

Introduction

The general orientation of the analytical procedures utilized in this report was to present the data in a format which could be integrated with previous investigations conducted in eastern Oklahoma (Gettys, Layhe, and Bobalik 1976, Farley and Keyser 1979, Leehan et al. 1977, Henry 1977a, 1977b, 1978, and Bearden N.D., among others). Subsequently, raw material type, edge-wear damage and load application studies were undertaken.

The specific orientation was to employ the above results for comparing the three principal areas excavated at Os-155. Since the field work was conducted under the assumption that the occupations in Os-155 were not contemporaneous, the analysis of the related data attempted to determine the presence of any significant variations among the lithic assemblages of the site areas. It was maintained that similar assemblages would indicate that similar functions had been performed on the site through time; while significant variations would serve to suggest that the activities of the occupants had changed.

Due to the disturbed nature of the artifacts recovered from Os-149 (primarily surface scatter) and the extremely small sample recovered from Os-153, only a description of the recovered artifacts will be presented. These items are not included in any of the statistical analyses.

Raw Material Types

The identification of raw materials was aided by the use of a comparative sample collected by the ARA personnel from northeast and north central Oklahoma. The expertise of Larry Banks was solicited and received for the specimens and types which could not be properly identified. Because the identification of raw materials still falls within the realm of qualitative judgments, specimens which were incapable of being positively identified received the designation of "other."

Seven separate sources of raw material were recognized: Kay County, Keokuk, Tahlequah, Worland, Neva, Woodford, and Jasper. The first three are the same types described in Henry (1977a and 1978), among others. The other types are described as follows:

Neva - medium grained, dark grey to black, with light random inclusions chert

Woodford - fine grained, homogeneous dark gray chert

Worland - medium to coarse grained, light to dark grey chert

Jasper - fine grained, reddish brown, cryptocrystalline silicate.

The approximate distribution of these materials appears in Figure 8-1.

Kay County chert was subdivided into two categories; typical and Kay County gravel. The latter consisted of items which contained a smooth light tan cortex believed to have been subject to water action. A ninth type was isolated during the process of analysis. Some materials initially identified as Kay, although qualitatively different in appearance, were separated from the more typical Kay items. This problem is discussed more fully later.

Although the identification of raw material types usually includes a segregation of the heat treated from the non-heat treated specimens,

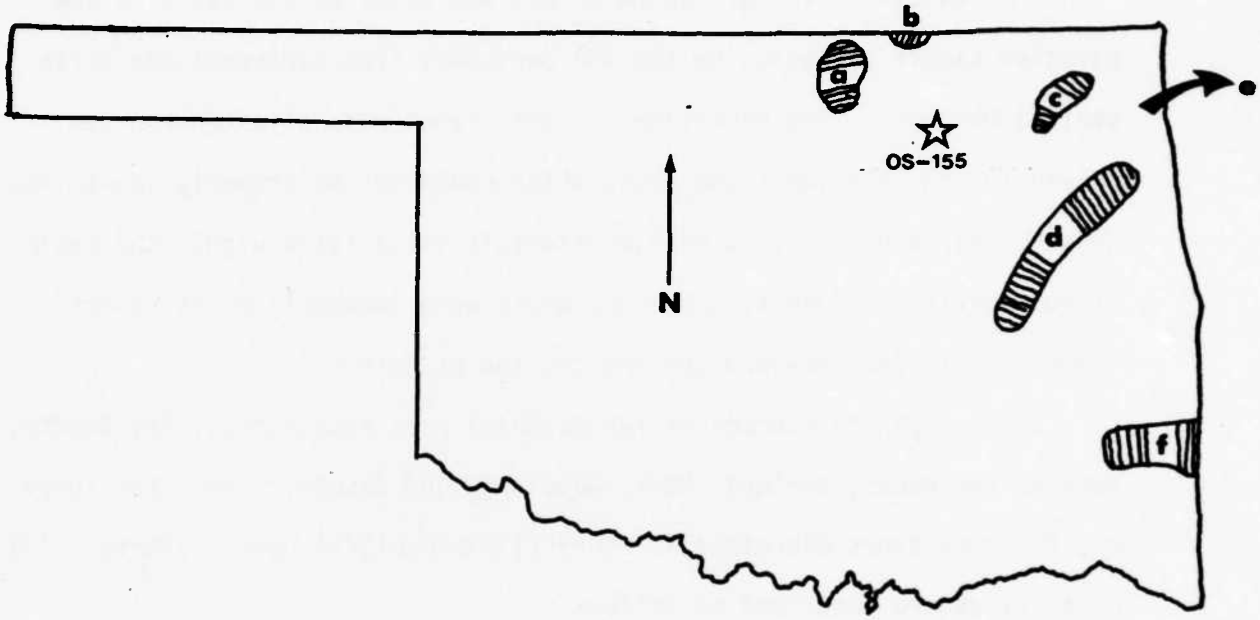


FIGURE 8-1
RAW MATERIAL
a-Kay County
b-Neva
c-Worland
d-Keokuk
e-Tahlequah
f-Woodford

due to the lack of an adequate comparative sample of thermally altered raw material types, this information was not recorded.

Lithic Analyses

Lithic materials which displayed secondary or post-detachment flaking were categorized as tools; the categories included projectile points; bifaces, secondary flaking on the ventral and dorsal surface of the item; unifaces, flaking on only the dorsal or ventral surface; gravers, items which contained bifacial flaking only on a projecting point; utilized flakes, items which contain micro flaking on one or more edges of the flake; and cores, elements from which more than one flake has been removed (excluding pressure flaking and retouch).

The remaining lithic materials, debitage, were subdivided into primary flakes, specimens which contain 100% cortex on the dorsal surface; secondary flakes, items which contain less than 100% but at least 1% cortex on the dorsal surface; and tertiary flakes, elements which lack cortex upon the dorsal surface. Only flakes which were considered to be complete, including those which display natural hinged and stepped termination fractures, were included in the debitage category. Incomplete flakes were recorded as debris.

Microwear Analyses

In "Technique and methodology in microwear studies: A critical review" (1974), Lawrence Keeley stated the principal aim of such studies was to "--reconstruct, as completely as possible, the primary economic activities of prehistoric groups--(by obtaining the) precise designation

of function for the implements examined" (p. 323). Keeley's critique maintains that "precise designations" can best be realized by replicating the inferred economic activities of the previous social actors, while controlling for the types of raw materials utilized, the variety of materials processed, and the activities performed (pp. 326-327, 329-330).

Generally, microwear studies, through replication, attempt to correlate particular microflaking and edge abrasion patterns with specific functional utilization. Past studies include patterning produced by woodworking (Keller 1966; Crabtree and Davis 1968); woodworking vs bone (Hester, Gilbow, and Dalbe 1973); manufacturing of tools (Sheets 1973; Huckaby 1979); processing of plant materials and game (Bearden 1976, N.D.): specific patterning produced by graving (Lynott 1975); and finally, the most exhaustive study encompassing all of the above by Tringham, Cooper, Odell, Voytek, and Whitman (1974). Although the authors repeatedly state that specific patterns are indeed produced by equally specific activities, in each case this represents a correlation between microwear produced by the activities conducted and recorded by the experimenter. However, when the data are applied to tools of past, non-observable functional activities, the results are not as strongly correlated.

J. D. Nance (1971), after having studied the serrations present on ten Stockton projectile points, concluded that the edge abrasion demonstrated that the "Stocktons" were not points but actually knives. Hester and Heizer (1973) conducted a similar investigation of 87 Stockton points, in response to Nance's conclusions. They, in contrast,

located only two projectile points which contained serrations which could be attributed to a "recognizable use-wear" (p. 220). Upon an x-ray examination of a projectile point which was imbedded in a lumbar vertebra, they noted the impact had produced ". . . serrations along the edges of the imbedded blade" (p. 221). They concluded that Nance's inferences were inaccurately founded.

Bearden (1976. N.D.) conducted a series of experiments in which she subjected various morphological classes of experimental tools to the cutting, sawing, scraping, and chopping of hard, medium, and soft organic materials (1976:62-69, N.D.:69-75). Using the experimental results as a means to relate particular microflaking patterns to specific activities used in the processing of assorted material goods, she compared the experimental results with the observed microwear present on artifacts recovered from two prehistoric sites. In the 1976 study, she could infer only ". . . that the inhabitants may have been working bone, stone, wood, vegetable foods, and hides" (1976:71). The undated study did provide a more precise designation of past functions performed; her results implied that particular tools had been used for either the scraping, cutting, or chopping of hard, hard to medium, or medium to soft materials (N.D.:84). However, in neither case was she able to determine the "precise economic function" of the tools in question as advocated by Keeley.

Harry Shafer and Bryant's (1977) work at Hinds Cave provided a unique opportunity to compare the inferred functional usage of 11 flake tools, using microwear, with the intact organic remains present on the working edge of the artifacts. Plant fibers, phytoliths, and other

plant parts, as well as mammal hair, had been observed and properly identified (1977:104-105). This organic residue enabled Shafer to determine precisely the actual functional role each artifact had performed in the past. In comparison to the inferred functional usage obtained through microscopic analysis of edge damage, Shafer demonstrated that short term, single function tools suffered very little edge damage and/or abrasion. The functional tools could only be identified by the presence of organic residue on the cutting edge. Secondly, "Because of the multipurpose use of most tools, it was not possible to relate specific kinds of wear patterns to specific uses."

He went on to conclude that the ". . . random removal of small crescent-shaped and 'D' shaped flakes, stepped-flakes and hinged-flakes, minute edge crushing, and edge smoothing and polish, can be related more to the intensity or duration of use rather than to specific materials being cut" (p. 128).

The above examples serve to illustrate two separate levels of success concerning the application of microwear studies for determining precise past economic activities. Those studies, based on replicating the inferred functional usage of past assemblages, can quite accurately distinguish the unique forms of edge damage which are products of specific activities. But apparently this precision is largely due to the opportunity for the investigator to know beforehand just what activities had been performed, and on what materials.

On the other hand, those studies which evaluate the damage produced by non-observable prehistoric actors, apparently can relate only general forms of functional usage to the observed data. Therefore, the optimistic

attitudes expressed by Keeley (1974), Tringham et al. (1974), and Odell (1975) have yet to be justified empirically.

As a consequence of the above observations, the examination of artifact utilization of the Os-155 material focuses primarily on evaluating the lithic tools and utilized flakes in broad qualititative terms, to facilitate an intra-site comparison among the three activity areas represented. Relying heavily on the excellent article by Tringham et al. (1974) concerning her experimental results on the formation of edge damage on lithic materials, and the experimental tools produced in Bearden's N.D. study, the tool assemblage from Os-155 was examined and classified in the following manner:

All pieces of lithic material which fell within the traditional typological categories of lithic tools were removed for microscopic analysis. In addition, all flakes recovered were visually examined, with the aid of a 5X hand lens, for any signs of intentional retouch or edge damage. Those which apparently exhibited such properties were also removed for further microscopic analysis.

Following Tringham et al.'s classificatory schema, the segregated flakes were classified into three categories on the basis of the presence/absence of the following criteria (1974:187-191) (see Figure 8-2):

1. Scraping - only one surface of the flake is scarred.
2. Cutting/Sawing - flake scars on both the ventral and dorsal surface of the cutting edge.
3. Boring/Graving - scarring on the sides of the point of projection.

In addition, a binary classification concerning the type of material worked--either soft or hard--was determined by the presence or absence of step scarring and rounded edges.

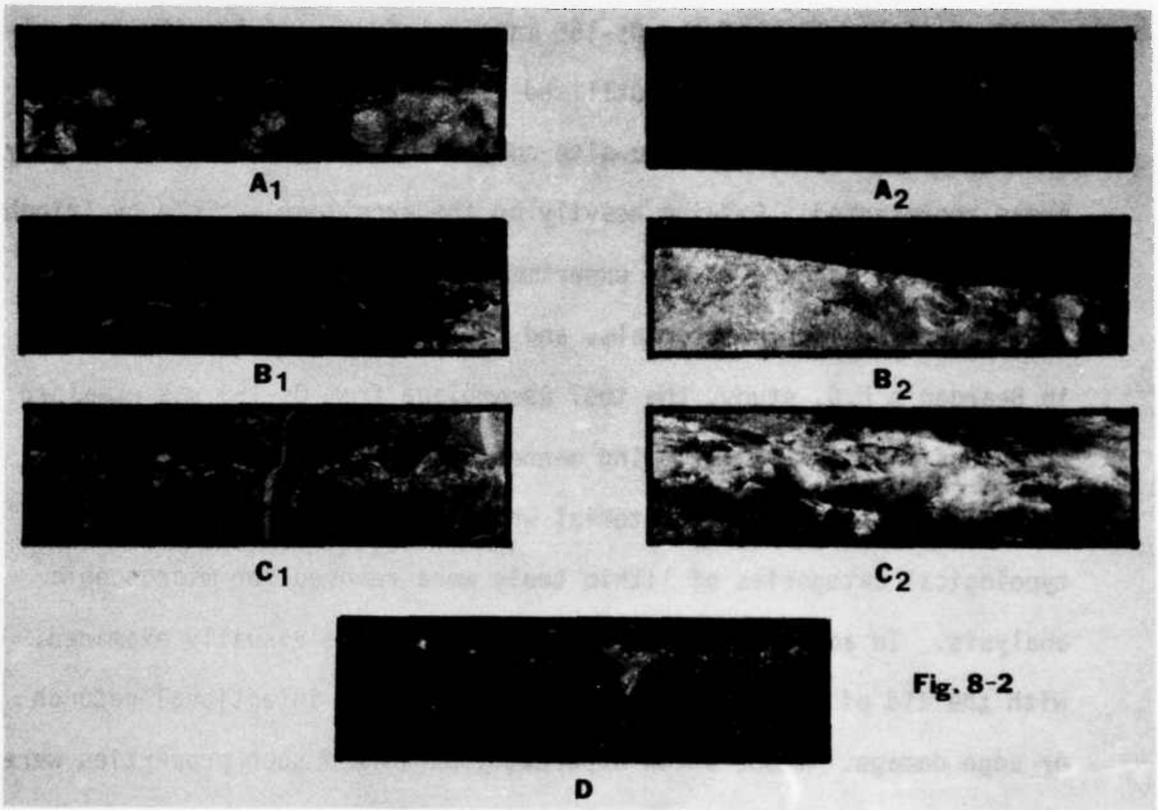


Figure 8-2. Microphotos of Edge Wear

experimental	archeological
A1 scraper/soft	A2 scraper/soft
B1 scraper/hard	B2 scraper/hard
C1 knife-chopper/hard	C2 knife-chopper/hard
	D knife-chopper/soft

Prior to classifying the artifacts in question, Bearden's experimental tools were scrutinized with the aid of a Swift 20X and 40X microscope, thereby providing a foundation for examining the yet-to-be analyzed tools. All flakes and tools then received an initial microscopic evaluation to determine if all of those which had been removed did indeed contain signs of edge-wear. Those items which remained within the edge-wear category were classified according to the above schema.

The tools and flakes recovered from Os-149 and Os-153 were not subjected to edge-wear analysis because of the inadequate sample size.

Load Application Analyses

Recent archeological investigations in northeastern Oklahoma by the University of Tulsa Laboratory of Archeology (Henry 1977a, 1978, Farley and Keyser 1979) have systematically maintained that the type of load application (pressure or hard/soft percussion) can be determined through an evaluation of the weight and/or thickness of the detached flakes.

The mainstay of these studies has been an experiment conducted by Henry, Haynes, and Bradley (1976). Approximately 1500 flakes from a single chert nodule were produced and collected according to the style of removal. The segregated flakes were then standardized by size with the use of a series of graduated sieves. Subsequent measurements of the spalls' weight and thickness were recorded. Statistical tests (the Student's T test) indicated that a significant variation existed between the mean weight and thickness of those flakes produced by pressure flaking and those removed by percussion. The authors concluded by suggesting that additional experimental tests should be conducted to

determine if the type of raw material, angle of percussion, or other variables would alter the mean values of the detached flakes. To date, test results have not been subjected to further evaluation.

Only one of the size classes, the 4 mm category, was measured for thickness and it was found that the thickness of the previous flakes, 1.2977 $\pm$ .264 mm, was significantly different from that of percussion flakes. In their work in northeastern Oklahoma, the authors mentioned above use this value as the standard by which archeological samples are judged to be produced either mostly by pressure or mostly be percussion.

Several basic problems are apparent with this application of a standard mean as a distinguishing criterion. A systematic use of the single measurement of flake thickness assumes that the mean thickness of pressure flakes, for example, does not vary significantly from one archeological sample to another. In essence, it assumes that the thickness of all pressure flakes has a normal distribution around a single mean value. Such an approach fails to consider the possibility that the mean diagnostic value may vary from one raw material to another, that each new material may display a unique mean and distribution about the mean.

Additionally, type of flake--primary, secondary, tertiary--is not considered. Binary and secondary blakes are generally larger than 4 mm and can be expected to be larger and thicker than the mean of this size class, whether they were produced by pressure or percussion.

In an effort to assess the effects of the raw material types and flake type on the variability of flake thickness, the Os-155 lithic debris were subjected to a series of statistical tests. These are discussed in Chapter 10.

CHAPTER 9

RESULTS OF PRESENT FIELD WORK

This chapter will present the excavators' data and a general artifact analysis of the three sites explored. Os-149 and 153 will be presented first. Os-155 will be considered last. Since the data from Os-155 are more complex, a detailed analysis of its artifacts will be presented in Chapter 10. Raw data are presented in Appendix 3.

Os-149

A total of three units was excavated at Os-149. The units produced only 47 of the 170 artifacts recovered; the remainder were surface finds in the plowed field (Tables 9-1 and 9-2).

Historic artifacts were recovered in the excavated units to a depth of 90 cms BS (eight were hand cut nails). Temporally diagnostic artifacts were not recovered; however, this is assumed to represent an extremely disturbed late prehistoric cultural occupation.

Os-153

A total of 67 artifacts was recovered from Os-153. The excavated units produced 59 of the artifacts; however, one of the units (ER 3, 0-80 cms BS) did not produce any material (Tables 9-3 and 9-4). Historic artifacts were recovered to depths of 90 cms BS (green and clear glass). In ER 1 a ceramic, grit tempered sherd was recovered at 40 cms below

TABLE 9-1

LITHIC DEBITAGE AND DEBRIS (Os-149)
(by material type)

Flake Type	Kay County (1)	Kay Gravel (2)	Keokuk (3)	Worland (4)	Talequah (5)	Woodford (6)	Neva (7)	Other (8)	Kay County (9)	
Primary	-	-	-	-	-	-	-	-	-	
Secondary	2	-	-	-	-	-	1	-	-	3 (1.9%)
Tertiary	26	2	4	1	1	1	2	2	-	39 (25.7%)
Debris	71	-	8	-	4	1	5	18	-	107 (70.5%)
Heat Spall	2	-	-	-	-	1	-	-	-	3 (1.9%)
	101 (66.4%)	2 (1.3%)	12 (7.9%)	1 (.7%)	5 (3.3%)	3 (1.9%)	8 (5.3%)	20 (13.2%)	-	152 (100.0%)

TABLE 9-2

LITHIC TOOLS (Os-149)
(by material type)

	1	2	3	4	5	6	7	8	9	
Projectile Point	-	-	-	-	-	-	-	-	-	
Biface	-	-	4	-	-	-	1	-	-	5 (27.8%)
Uniface	2	-	1	-	-	-	1	1	-	5 (27.8%)
Gravers	2	-	1	-	-	-	-	1	-	4 (22.2%)
Utilized Flake	3	-	-	-	-	-	-	-	1	4 (22.2%)
Core	-	-	-	-	-	-	-	-	-	
	7 (38.9%)		6 (33.3%)				2 (11.1%)	2 (11.1%)	1 (5.6%)	18 (100.0%)

TABLE 9-3

LITHIC DEBITAGE AND DEBRIS (Os-153)
(by material type)

	Kay County (1)	Kay Gravel (2)	Keokuk (3)	Worland (4)	Talequah (5)	Woodford (6)	Neva (7)	Other (8)	Kay County (9)	
Primary	1	-	-	-	-	-	-	-	-	1 (1.8%)
Secondary	-	-	-	-	-	-	-	-	-	
Tertiary	3	-	-	-	-	-	-	-	-	3 (5.5%)
Debris	17	-	3	-	4	-	-	25	-	49 (89.1%)
Heat Spall	2	-	-	-	-	-	-	-	-	2 (3.6%)
	23 (41.5%)		3 (5.5%)		4 (7.3%)			25 (45.5%)		55 (100.0%)

TABLE 9-4

LITHIC TOOLS (Os-153)
(by material type)

	1	2	3	4	5	6	7	8	9	
Projectile Pts.	-	-	-	-	-	-	-	-	-	
Biface	-	1	-	-	-	-	-	1	-	2 (16.7%)
Uniface	3	1	-	-	-	-	-	2	-	6 (50.0%)
Graver	1	-	-	-	-	-	-	-	-	1 (8.3%)
Utilized Flake	1	-	-	-	-	-	-	-	-	1 (8.3%)
Core	1	-	-	-	-	-	-	1	-	2 (16.7%)
	6 (50.0%)	2 (16.7%)						4 (33.3%)		12 (100.0%)

surface in ER 2; however, in that a number of lithic specimens from the site area had been ground and polished by water action, the precise origin of all the recovered artifacts is questionable. The site may represent a Plains Woodland occupation.

Introduction to Os-155

The 1979 excavations at Os-155 located three horizontally distinct concentrations of cultural material. Figure 9-1 shows the vertical, horizontal, temporal, and geomorphological relationship of each horizontally discrete area--Areas 1, 2, and 3. Areas 1 and 2 are geomorphically very similar. Both exhibit a concentration of material in upper levels and nothing in the yellowish bottom zones. Area 3, on the otherhand, has a concentration of cultural debris at an absolutely and relatively lower elevation. The soil below is not similar to the yellowish bottom zone. Two cultural zones have tentatively been identified in Areas 1 and 3; probably there are two in Area 2, as well. Several problems exist in regard to the dating of the different areas and levels. These include the nature of the geomorphic, C-14, and artifactual data.

Dating Considerations

Radiocarbon dates (Table 9-5) on organic material from Areas 1 and 2 suggest that, contrary to the original geomorphological analysis (written before the dates were received, see Chapter 3), this culture-bearing unit is actually the Copan paleosol formed on Unit B, rather than Unit A. The latter would have been deposited on top of Unit B. It will be remembered that the date for the formation of the paleosol is prior to 1300 b.p.

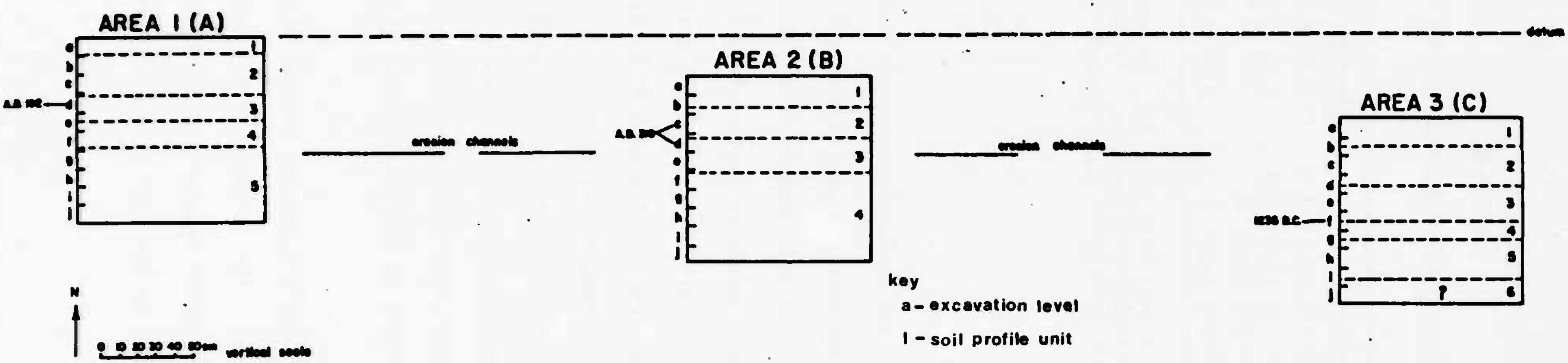


Fig. 9-1. Stratigraphic Relationships, 34 Os-155. See Fig. 6-3 for horizontal relationships of the areas (represented by (C)). See Appendix 2 for description of soil profile units. (Horizontal dimension not to scale.)

TABLE 9-5

RADIOCARBON DATES FROM Os-155

Sample	Location	Radiocarbon Years*	Calendar Date
SMU 723	Area 1, ER 15, Level D	1758 ± 82 b.p.	A.D. 192
SMU 722	Area 2, ER 21, Level C/D ER 26, Level D	1631 ± 89 b.p.	A.D. 319
SMU 721	Area 3, ER 20, Level F	3185 ± 93 b.p.	1235 B.C.

*Calculated using a half life of 5730. No dendrochronological corrections were made in calculating the date. If this had been done, Area 1 and 2 dates would have been 60-70 years younger and Area 3 dates 183 years older.

On the other hand, the cultural component in Area 3 seems to have been deposited before the paleosol was formed, and probably is located in the top of the C unit. The unit above the cultural levels of Area 3 may include both the paleosol (since cultural material similar to that in Areas 1 and 2 is found in this upper unit) and a thin Unit A deposit. These conclusions differ from those discussed by Niles in Chapter 3, partly as a result, as already noted, of the arrival of the radiocarbon dates for Os-155 after the geomorphological analysis had been written. In Chapter 3, the sediment unit called A in which Os-155 rested was considered comparable to Unit A in the Copan stratigraphic sequence, which would place it several hundred years later than it is dated by the radiocarbon results.

There are several possible reasons for the discrepancy between these two interpretations. The radiocarbon dates may be wrong, or there may have been a miscorrelation between the two sediment units. All the C14 samples were produced by the same laboratory (Southern Methodist

University under the direction of Dr. Hasse). Dr. Hasse has informed us (personal communication) that a control sample run after the Candy Creek samples produced the appropriate date, so there does not seem to be variation in laboratory procedures. It is also unlikely that there was contamination of the Candy samples in the laboratory, since this would tend to make them younger and not older. There is always the possibility that the Candy samples were contaminated by older carbon being deposited with the cultural material. Although Candy Creek is geographically close to the coal area of eastern Oklahoma, its drainage does not pass through any coal bearing region. It is also in an oil producing area, but we do not have any information about natural seeps that could have been washed into the site. However, the fact that the dates are internally consistent would indicate that the contamination also would have had to be systematic, which is not likely. In summary, it appears unlikely that the samples are contaminated to the extent that the results were seriously affected.

Although Niles was about to depart for South America and was not able to recheck the field situation, he did suggest that his field notes did not rule out the possibility that the sediments containing the cultural materials are those of the Copan paleosol itself. These sediments would be close to the surface of the site, possibly because of two factors: 1) Unit A was never deposited in this area, or only in minimal amounts; or 2) due to plowing and/or erosion the A unit has been completely or almost completely removed, exposing the original top of the B unit, the paleosol, which in other areas of the valley seemed to be missing. If this deflation has occurred it might also explain the relatively large number of large bifacially flaked artifacts found on the surface of the site (Leehan et al. 1977).

The problem of assigning the site's deposits to a particular cultural tradition is compounded by the fact that there are few recognizable point types and the most frequent can be assigned to either of two different cultural traditions--Plains Woodland and Plains Village or Caddoan. The points in question are those identified in the report as Sequoyah or serrated Scallorn. Sequoyah points reportedly are generally found in the Ozark region and are associated with Caddoan components dating from A.D. 1000-1350, the beginning of the Plains Village period (Perino 1968: 88). It is a small, thin, corner notched point type with a triangular blade, and is characterized by coarse serrations. Its general form and size range is identical to that of the Scallorn point. Serrations are not a common feature of the Scallorn point but do exist on some varieties (Bell 1960:84). The Scallorn family of corner notched point types occurs in northeast and north central Oklahoma in the Plains Woodland tradition. This tradition first appears around A.D. 1 and lasts until about A.D. 1000, when it is replaced by the Plains Village (Young 1968:291). Because of the similarity of the defining attributes, it is difficult to distinguish these two types, especially in the case of serrated Scallorn-like items.

Two corner notched points were found in Area 2 at essentially the same depth. The one found by Leehan et al. (1977:49, Plate 2B, Unit 0-35, 85E) was found in the 30-40 cm level. This season's find was at about 42 cm in ER 14. The one found in the first season's work is much more obviously serrated and lacks a base. Although it seems to be shorter than the examples illustrated by Perino (1968:89), it is virtually impossible to assign the point to one type or the other. The point found this season is less obviously serrated and could easily be called a Scallorn.

Another point, this one from the surface, also needs to be considered. Found by Leehan et al. (1977:50, Plate 4a, collection area 2--which is Area 1 of this report), it is another small, thin, triangular point. It has a convex base and wide indentations on the side which do not really fit either the side notched or corner notched category of hafting. It could be called "waisted." Convex based points with narrow side notches have been called Keota points (Perino 1968:42). They are associated with Sequoyah points at the Caddoan site at Spiro. Whether this point is a Keota or not, its surface position does not negate the possibility of an earlier date for the subsurface deposits.

The possible Sequoyah in Area 3 was found in the second level (the upper zone) (11-20 cm) and is separated from the main concentration of cultural material by four levels. However, the main concentration in the lower zone has a reworked point that has been identified as an Edgewood. If the identification is correct, the type is generally dated to the Late Archaic (Bell 1958:20), but seems to appear sporadically up until the beginning of Caddoan times around A.D. 800. The date associated with this point type of 1235 B.C. $\pm$ 93 would indicate a Late Archaic context. The upper levels of Area 3 could then be assigned either to the Woodland or the later Plains Village traditions.

In summary, considering the artifactual, geomorphic, and dating evidence, it currently seems most reasonable to assign the lower zones of both Areas 1 and 2 to the earlier Woodland tradition, and the sediments not to Unit A but to Unit B. The data suggest that the upper zones of Areas 1 and 2 are Plains Village. rea 3 is a different question; the bottom levels are also probably Unit C, and probably Late Archaic rather than Woodland in date. The upper levels of Area 3, with their very thin

artifact density, may be either Plains Woodland or Plains Village. Certainly, the occupation in Area 3 was distinct from that in the other two areas. The radiocarbon dates for Areas 1 and 2 do not decisively indicate if they were separate occupations, but because of their distance from one another, they are certainly loci of discrete activities if not of different occupations. Therefore, the description and analysis of the recovered artifacts will treat each area independently. Only in Chapter 10, which tests for the influence of raw material type on the variability of flake thickness, will the three areas be collapsed into one unit for analysis.

Artifact Concentration

During the initial examination of the artifacts and their distribution, it was noted that the artifacts were concentrated in only a few levels in each area. In a situation such as this, archeologists have the right to ask whether the material in the various arbitrary levels was deposited in a succession of occupations or by only one occupation and then displaced vertically by various cultural or natural forces. This problem has not been widely discussed in the archeological literature, although it should receive more attention for it has obvious complications for interpretation. It may be particularly difficult to determine whether one continuous, or multiple, occupations were present at sites which have some feature that made them particularly attractive to prehistoric populations, or that have a constant frequency of artifacts per level.

These problems of interpretation apply to the three areas of Os-155. The cultural material in all three areas is concentrated within three

contiguous levels (30 cm). The frequency of items drops as one goes up or down. Possibly, this distribution could have been caused by the vertical disturbance, by various cultural or natural processes, of a more concentrated original deposition layer. On the other hand, an alternate hypothesis is that each restricted area reflects repeated reoccupation over several centuries. This seems a less reasonable explanation, as none of the spots appear distinguished from other streamside locations nearby. It is unlikely that each of these spots would have been randomly or intentionally chosen as a camp site century after century.

A graphic example of a similar situation has been documented at a site in Belgium (Cahen, Keeley, Van Noten 1979; Van Noten, Cahen, and Keeley 1980). They report a paleolithic site whose lithics were distributed over 50 cm vertically. They were able to demonstrate that all the material was deposited by one occupation through the refitting of flakes and tools to cores.

The levels that composed the main occupation zones of each area were tested by chi square to see if they came from the same population. The variables flake type and raw material were used. The results indicated that they did come from the same population, confirming the idea that they were one occupation, not many.

As a result of this conclusion, primary emphasis is given to the levels which contain the highest concentration of cultural material: each of the three 30 cm zones is treated as one occupation. Distribution maps record artifact distribution for each 30 cm zone. In Chapter 10, all whole flakes are used except those from the upper levels of Areas 1 and 3, which were not consistently screened, and stand the greatest chance of belonging to a separate occupation.

Area 1, Os-155

A total of ten one-by-one meter units were excavated in Area 1. The testing produced a total of 492 artifacts.

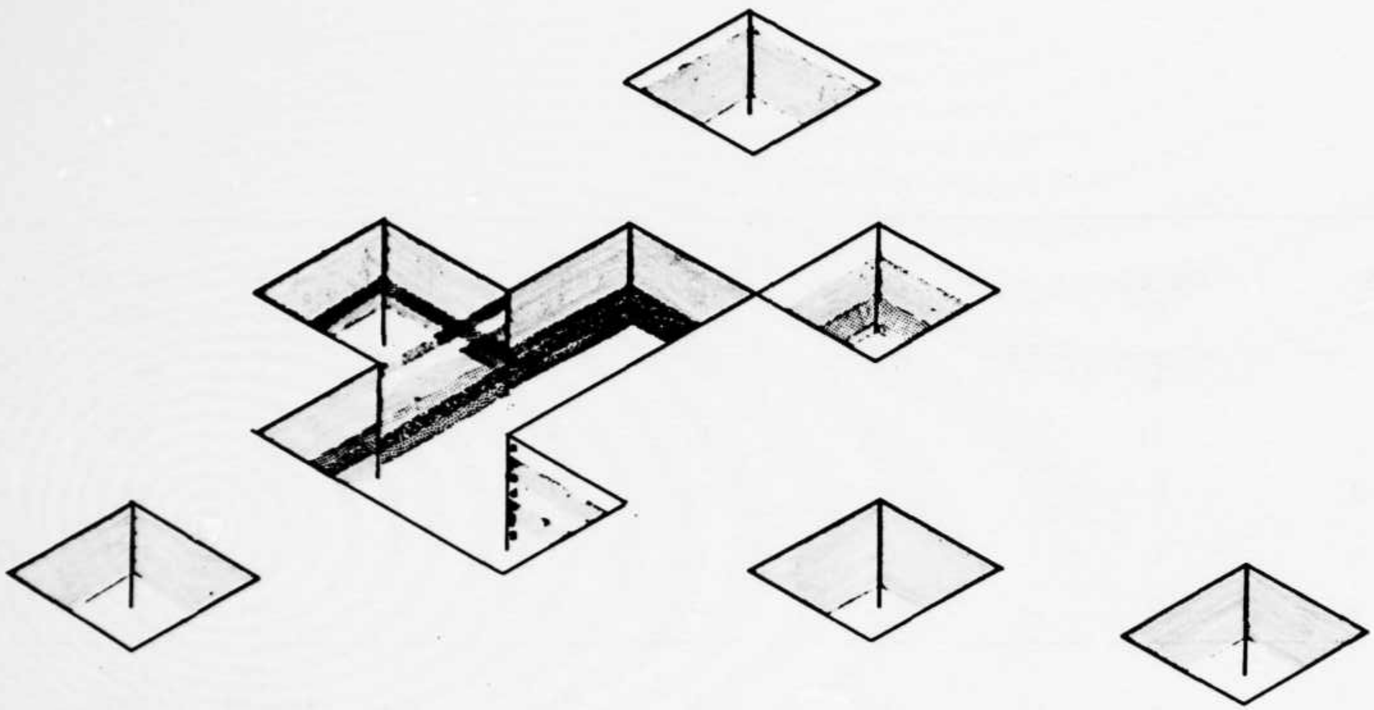
Artifact Distribution

An examination of Figure 9-2 illustrates the vertical and horizontal distribution of the artifacts (Tables 9-6 to 9-9) recovered from Area 1. The top 40 cms of the cultural deposit contained a light scatter of lithic material, bone fragments, and charcoal which composed only 147 (28.9%) pieces of the total cultural deposit. The horizontal distribution appears to be quite uniform and does not present any indications of a concentration(s) which might be indicative of specific activity areas. This may in large part be an effect of plowing which has occurred in years past.

The lower half of Figure 9-2 represents the principal deposit recovered from Area 1. Between levels E through H the remainder of the artifacts (350) were deposited, with levels E and F (40-60 cms Bs) containing 304 (61.8%) of the total assemblage.

Horizontally, the artifacts were concentrated within the contiguous units of the excavation, with the outer units demonstrating that the cultural materials were extremely limited in distribution. It was therefore concluded that the lower concentration of artifacts represented a limited activity of short duration.

The lithic debris, tools (classified by edge damage), and bone fragments recovered in levels E through G were plotted by square to see if



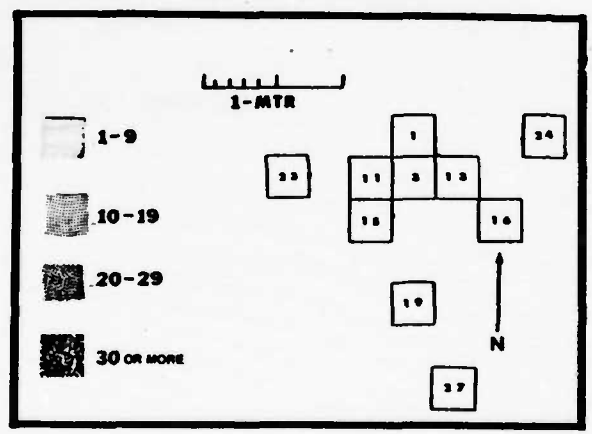


FIGURE 9-2

AREA-1

FLAKE DISTRIBUTION/DENSITY

TABLE 9-6

LITHIC DEBITAGE AND DEBRIS (Os-155, Area 1)
(by material type)

	Kay County (1)	Kay Gravel (2)	Keokuk (3)	Worland (4)	Tahlequah (5)	Woodford (6)	Neva (7)	Other (8)	Kay County ? (9)	
Primary	1	-	-	-	-	-	-	-	-	2 (.4%)
Secondary	2	-	2	1	1	-	-	1	-	36 (8.4%)
Tertiary	31	-	8	1	4	-	-	3	2	125 (29.1%)
Debris	214	1	22	5	4	-	-	18	-	263 (61.2%)
Heat Spall	1	-	1	-	-	-	-	1	-	3 (.9%)
	355 (82.5%)	1 (.2%)	33 (7.7%)	7 (1.6%)	9 (2.1%)	-	-	23 (3.3%)	2 (.5%)	430 (100.0%)

TABLE 9-7

LITHIC TOOLS (Os-155, Area 1)
(by material type)

	1	2	3	4	5	6	7	8	9	
Projectile Pt.	-	-	-	-	-	-	-	-	-	-
Biface	7	-	2	-	1	-	-	-	-	10 (21.7%)
Uniface	7	-	1	1	1	-	-	-	-	10 (21.7%)
Graver	2	-	-	-	-	-	-	-	-	2 (4.3%)
Utilized Flake	19	-	1	1	1	-	-	-	-	22 (41.3%)
Core	2	-	-	-	-	-	-	-	-	2 (4.3%)
	37 (80.4%)	-	4 (8.7%)	2 (4.4%)	3 (6.5%)	-	-	-	-	46 (100.0%)

TABLE 9-8

EDGE DAMAGE (Os-155, Area 1)
(by material type)

	1	2	3	4	5	6	7	8	9	
Scraper/Soft	15	-	1	2	1	-	-	-	-	19 (45.2%)
Scraper/Hard	6	-	1	-	-	-	-	-	-	7 (16.7%)
Knife/Chopper/Soft	6	-	-	-	1	-	-	-	-	7 (16.7%)
Knife/Chopper/Hard	5	-	2	-	-	-	-	-	-	7 (16.7%)
Gravers	2	-	-	-	-	-	-	-	-	2 (4.8%)
	34	-	4	2	2	-	-	-	-	42 (100.)%)
	(81%)		(9.5%)	(4.8%)	(4.8%)					

any specialized activity areas could be inferred. Since cultural features were not located, this provided the only means of estimating specific activity areas. Figure 9-3 appears to replicate the general distribution of the artifacts; where a higher frequency of lithic debris was recovered, an equally higher proportion of all flake types was present. Apparently, the production and/or refurbishing of tools occurred in the central area of excavation. It is worth noting, however, that of the three heat spalls recovered in Area 1, not one was present in the lower cultural deposit, even though charcoal flecks were present throughout the 80 cms of fill which had been excavated.

TABLE 9-9

BONE (Os-155, Area 1)

Deer Bone	-
Bird Bone	-
Undeterminable	13
Burnt	3
Total	16

Figure 9-4 displays the distribution of the lithic tools. Again, definite associations are absent. The only interesting aspect is that of the 11 artifacts which had been used on "hard" materials, only two

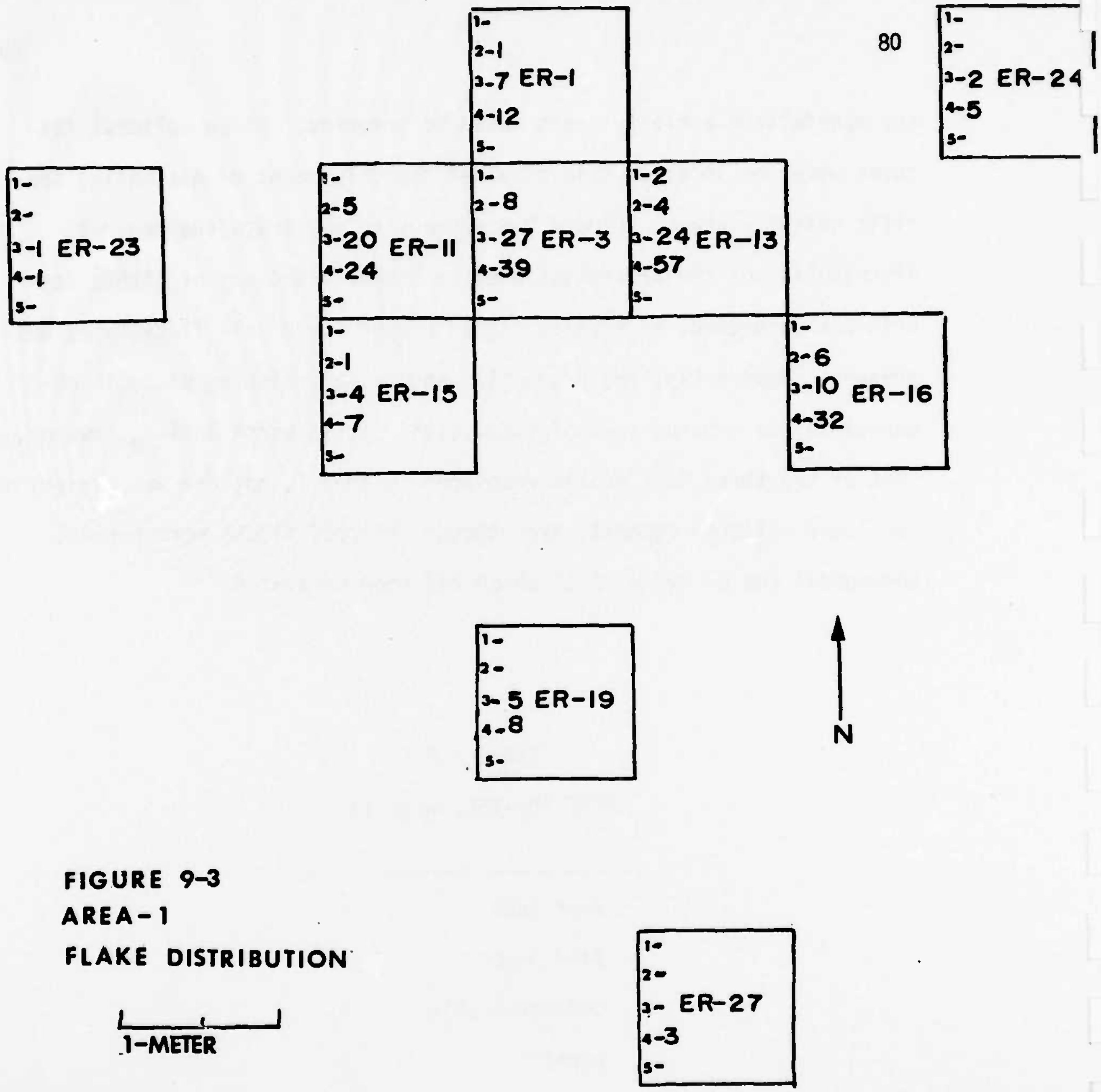


FIGURE 9-3
AREA-1
FLAKE DISTRIBUTION

KEY
1-Primary
2-Secondary
3-Tertiary
4-Debris
5-Heat Spall

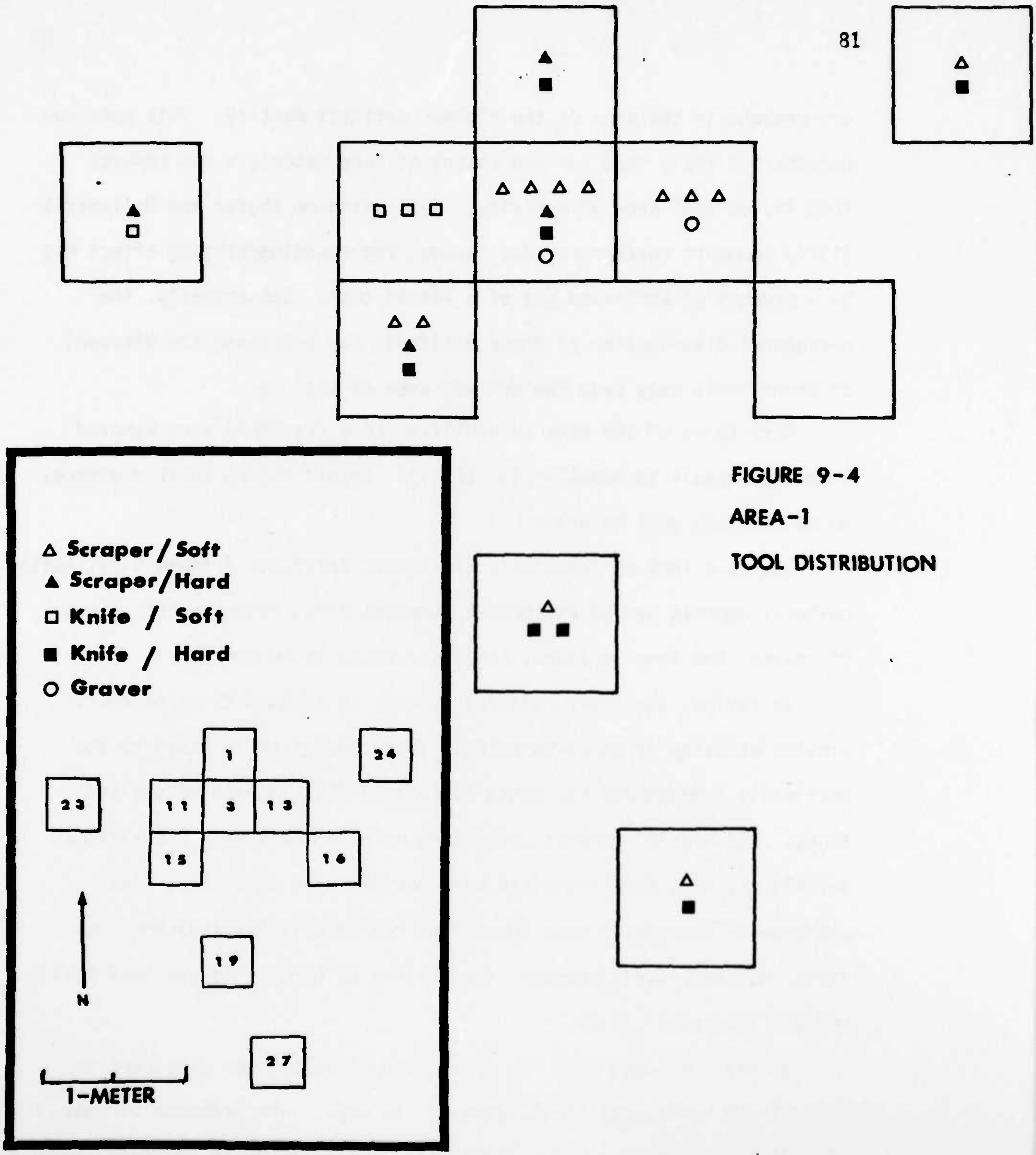


FIGURE 9-4
AREA-1
TOOL DISTRIBUTION

are present in the area of the highest artifact density. This need not necessarily imply that the processing of hard materials was removed from the central area of activity. Reflecting on Shafer and Holloway's (1977) comments concerning edge damage, the rounding/hinging effect may be a product of continued use of a lithic tool. Subsequently, the peripheral distribution of these artifacts may represent the disposal of spent tools away from the primary area of activity.

Only three of the nine unidentified bone fragments were removed from the deposit in question (in ER-11). Beyond noting their presence, no conclusions will be drawn.

Due to a lack of temporally diagnostic artifacts (Figure 9-5), neither cultural deposit can be assigned a temporal affiliation on this basis. Of course, the lower cultural zone is assumed to be earlier.

In review, the lower cultural deposit is assumed to represent a limited activity of short duration. This conclusion is based on the vertically compact and horizontally limited distribution of the artifacts. Apparently, general activities in which both hard and soft materials may have been processed were performed in this area. The presence of charcoal flecks throughout the deposit may indicate that fires had been used; however, the absence of burnt bone and heat spalls reduces that possibility.

It was concluded that the upper occupation was too disturbed to suggest the horizontal limitations of the area. The presence of charcoal flecks, burnt bone, and lithic heat spalls tends to indicate that the cooking of food or heat treatment of lithic materials may have taken place.

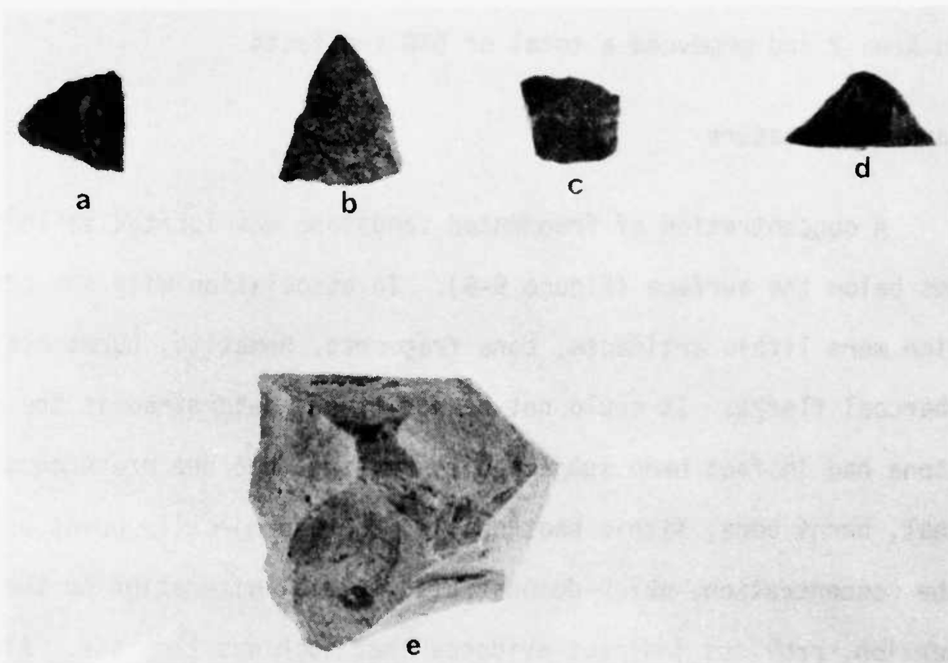


Figure 9-5. Tools from Area 1, 34 Os-155

a. uniface
b. biface, fragment
c. uniface, fragment
d. biface, fragment
e. core

(Scale: a=1.7 cm)

Area 2, Os-155

Area 2 contrasted in several ways with Areas 1 and 3. Where the other two areas lacked cultural features, Area 2 contained a concentration of sandstone and deer bone. Yet, while the other occupations had remained fairly well intact, because of Area 2's placement within the top 40 cms of the alluvial deposit, the artifacts had been disturbed by plowing (Tables 9-10 through 9-1). Six units were excavated in Area 2 and produced a total of 560 artifacts.

Sandstone Feature

A concentration of fragmented sandstone was located at 18 to 20 cms below the surface (Figure 9-6). In association with the concentration were lithic artifacts, bone fragments, hematite, burnt clay, and charcoal flecks. It could not be positively determined if the sandstone had in fact been subjected to heating, but the presence of charcoal, burnt bone, lithic heat spalls, and a projectile point beneath the concentration, which demonstrated thermal alteration on the basal portion, provides indirect evidence that such was the case. Although the entire lateral dimensions of the concentration were not exposed, the feature appears to have been horizontally limited. The occurrence of sandstone at the 18-20 cm level in ER 5 had not been recorded, but a review of Crouch's notes indicates that few fragments were present. Similar instances have been reported in Oklahoma (Bobalik 1978, Henry 1978, Farley and Keyser 1979) and generally similar conclusions have been reached.

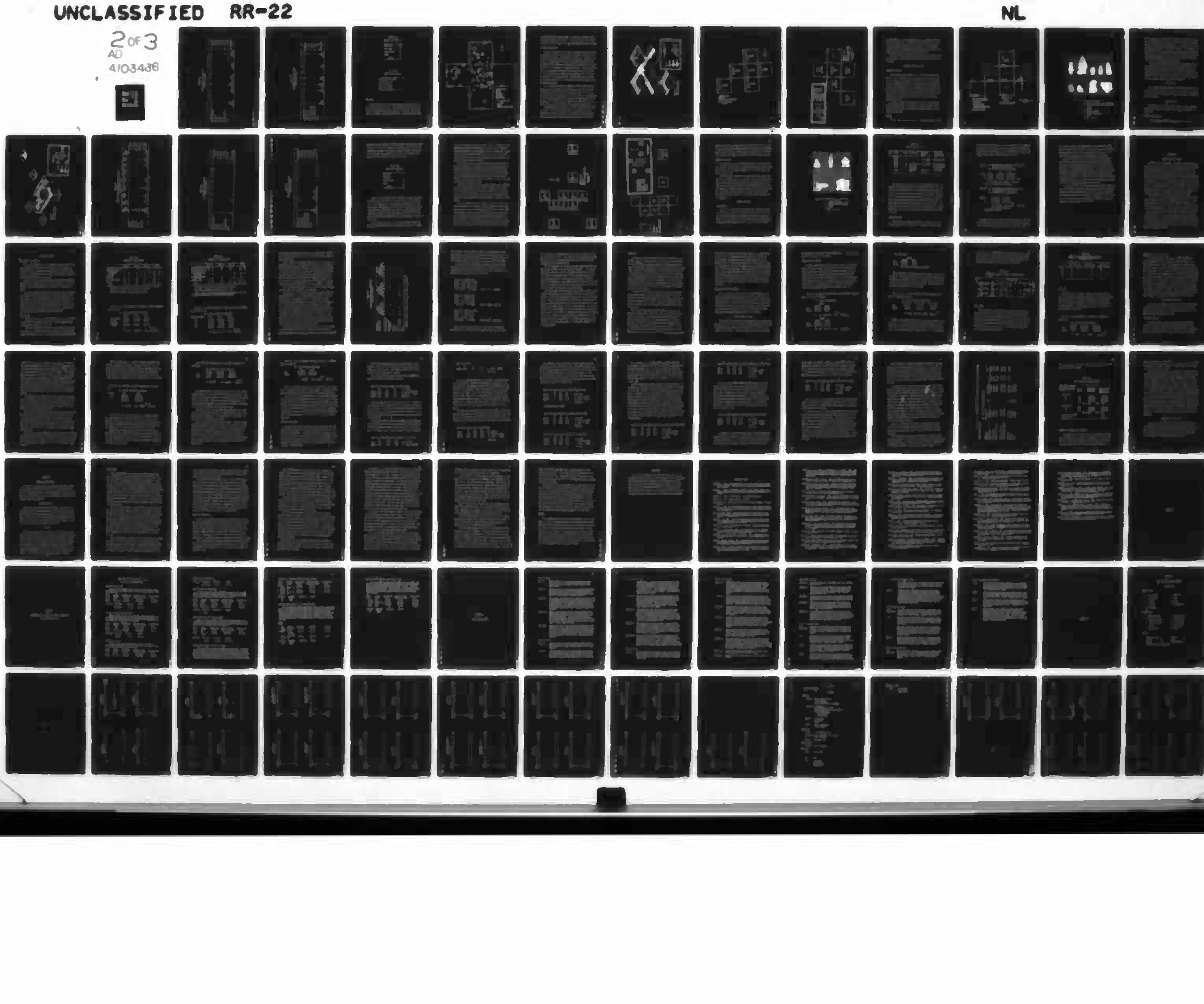
TABLE 9-10

LITHIC DEBITAGE AND DEBRIS (Os-155, Area 2)
(by material type)

	Kay County (1)	Kay Gravel (2)	Keokuk (3)	Worland (4)	Talequah (5)	Woodford (6)	Neva (7)	Other (8)	Kay County (9)		
Primary	2	1	-	1	-	-	-	1	1	6	(1.3%)
Secondary	9	19	2	13	-	1	-	-	23	66	(14.7%)
Tertiary	24	5	11	67	1	4	1	-	54	167	(37.1%)
Debris	39	3	11	78	2	9	3	8	52	205	(45.6%)
Heat Spall	1	-	2	3	-	-	-	-	-	6	(1.3%)
	75 (16.7%)	28 (6.1%)	26 (5.8%)	162 (36%)	3 (.7%)	14 (3.1%)	4 (.9%)	9 (2.0%)	129 (28.7%)	450	

AD-A103 436 ARCHEOLOGICAL RESEARCH ASSOCIATES TULSA OK F/G 5/6
A REASSESSMENT OF CERTAIN ARCHEOLOGICAL SITES IN THE CANDY LAKE--ETC(U)
1980 J SAUNDERS, C D CHEEK, F NIALS DACW56-79-C-0040
UNCLASSIFIED RR-22 NL

2 OF 3
AD
A103436



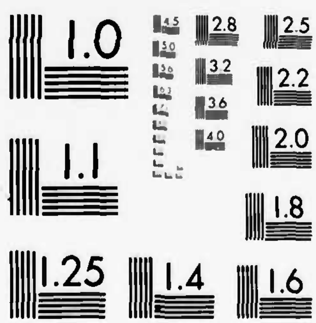

1.0
4.5
5.0
5.6
6.3
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.1
1.8
1.25
1.4
1.6

TABLE 9-11

LITHIC TOOLS (Os-155, Area 2)
(by material type)

	1	2	3	4	5	6	7	8	9		
Projectile Point	-	-	-	2	-	-	-	-	-	2	(3.6%)
Biface 2	4	-	1	2	2	-	1	-	3	13	(23.6%)
Uniface	2	-	1	3	-	-	-	-	2	8	(14.6%)
Graver	-	-	1	-	-	-	-	-	-	1	(1.8%)
Utilized Flake	5	-	5	7	3	-	-	-	10	30	(54.6%)
Core	-	-	-	1	-	-	-	-	-	1	(1.8%)
	11 (20%)	-	8 (14.5%)	15 (27.3%)	5 (9.1%)	-	1 (1.8%)	-	15 (27.3%)	55	(100.0%)

TABLE 9-12

EDGE DAMAGE (Os-155, Area 2)
(by material type)

	1	2	3	4	5	6	7	8	9		
Scraper/Soft	5	-	4	7	2	-	-	-	8	26	(52%)
Scraper/Hard	-	-	-	-	-	-	-	-	3	3	(6%)
Knife-Chopper/Soft	-	-	2	2	2	-	-	-	1	7	(14%)
Knife-Chopper/Hard	5	-	1	3	1	-	1	-	2	13	(26%)
Graver	-	-	1	-	-	-	-	-	-	1	(2%)
	10 (20%)		8 (16%)	12 (24%)	5 (10%)		1 (2%)		14 (28%)	50	(100.0%)

TABLE 9-13

BONE (Os-155, Area 2)

Deer Bone	12
Bird Bone	1
Unidentified	32
Burnt	2
Total	47

TABLE 9-14

OTHER (Os-155, Area 2)

Ground Stone Fragments	2
Percussion Cobble	1
Pieces of Hematite	4
Piece of Limonite	1

Deer Bone

At approximately 42-48 centimeters below surface, seven pieces of deer bone were recovered in ER 5. The fragments included the left portion of the manidble and assorted fragments of long bone. The fracturing does not appear to have been intentional. Artifacts were not found

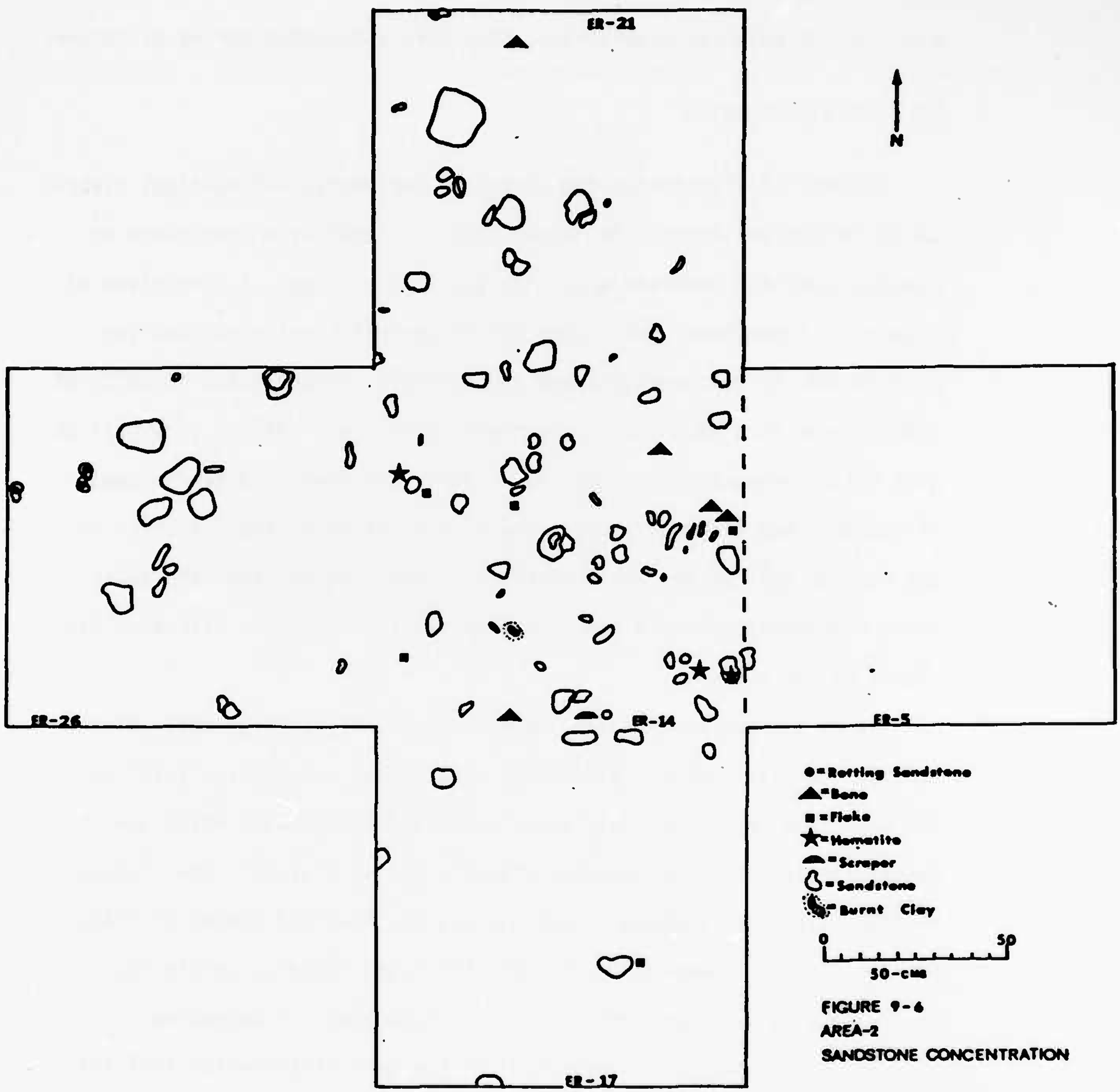


FIGURE 9-6
AREA-2
SANDSTONE CONCENTRATION

in association with the faunal remains, nor were any recovered in the subsequently excavated 10 cm level. If the faunal remains were indeed a product of cultural acquisition, they were apparently buried as refuse.

Artifact Distribution

Figure 9-7 illustrates the irregular horizontal and vertical distribution of the artifacts. As noted, this is viewed as a by-product of plowing which had occurred approximately 20 years ago. A comparison of Figure 9-6 (sandstone) and Figure 9-7 (isometric) indicated that the distribution of the sandstone and the heaviest concentration of cultural material run in a southeast to northwest direction. It may very well be that this represents the direction in which the field had been plowed. If so, this may serve to explain the concentration of the artifacts in the western half of the excavations. It seems logical that the sandstone concentration would act as a trap for the artifacts laterally displaced by the plowing.

In an attempt to minimize the mechanical effects previously discussed, the lithic debris plotted by square does not contain level A. The distribution of the flake types (Figure 9-8) does not offer any particular insight into possible specific activity areas. The frequency of flake types corresponds rather closely to the total number of flakes present. It is, however, worth noting that the location of the heat spall items is in close proximity to the sandstone concentration.

The representation (Figure 9-9) of the tool distribution includes all levels. It is argued that the lateral displacement of single specimens would not be significant enough to distort the overall pattern of distribution. The artifacts which were used for processing

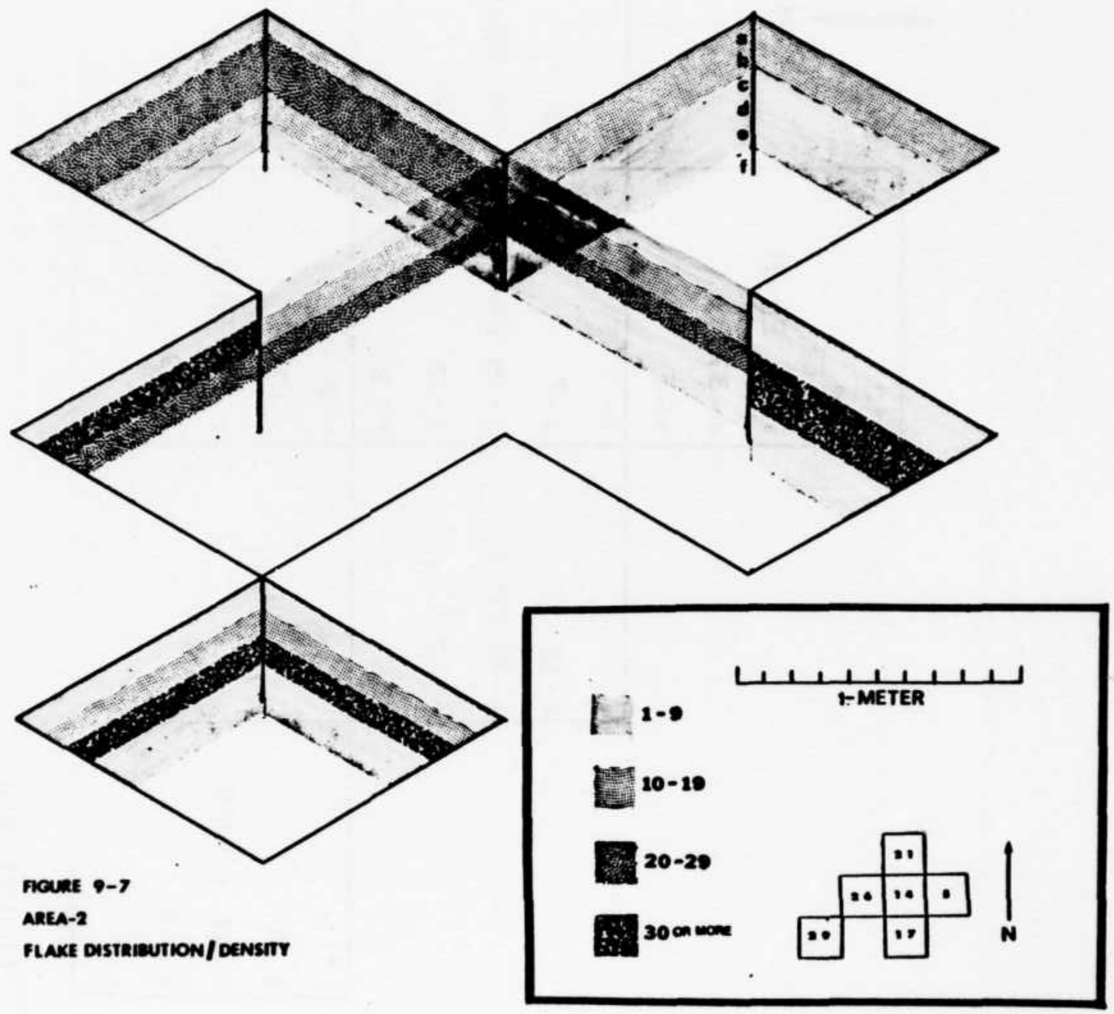


FIGURE 9-7
AREA-2
FLAKE DISTRIBUTION/DENSITY

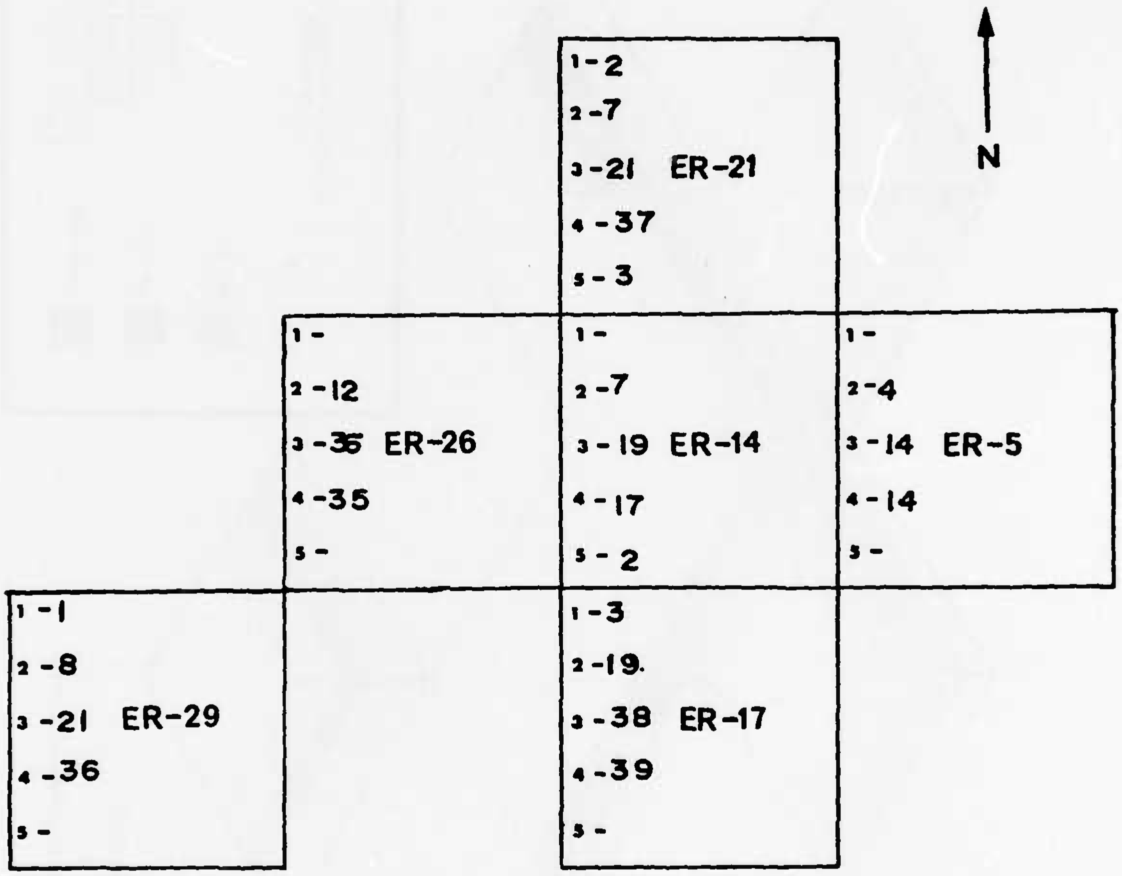


FIGURE 9-8
AREA-2
FLAKE DISTRIBUTION

1-METER

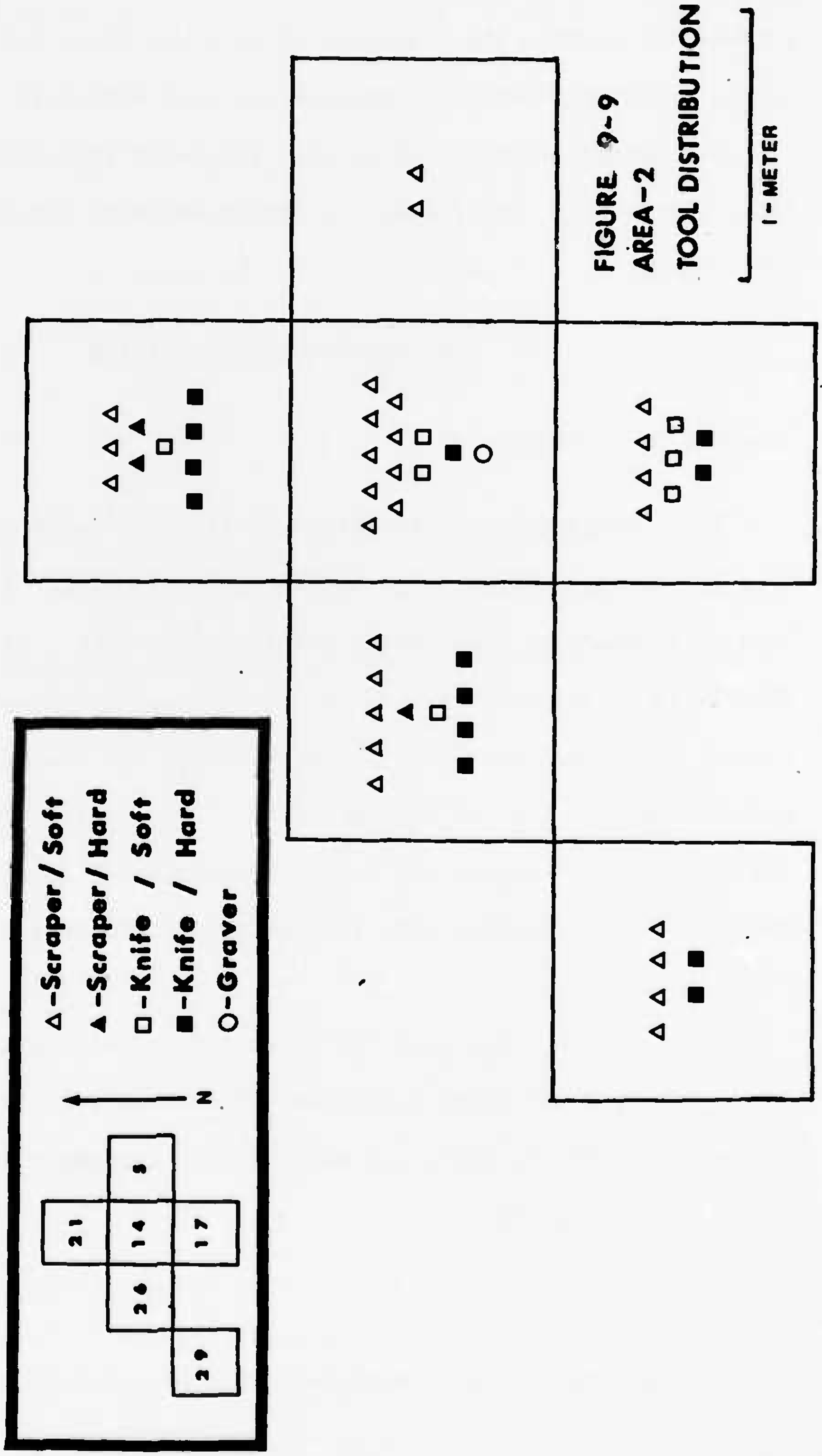


FIGURE 9-9
AREA-2
TOOL DISTRIBUTION

"hard" materials, or received repeated use, are distributed around the sandstone concentration. In conjunction with the spatial distribution of the bone fragments (Figure 9-10), there appears to be a moderate correlation between the placement of bone and those tools which contain damage resulting from the processing of hard materials.

Two pieces of ground stone were recovered from ER 26 (15 cm bs) and ER 14 (40 cm bs). One percussion cobble was also recovered from ER 14 (35 cm bs).

Discussion, Area 2, Os-155

Temporal Affiliation

Three projectile points (Figure 9-11: a-c) were recovered from Area 2. Two are unidentified and the other is either a serrated Scallorn or a Sequoyah. The latter point (Figure 9-11: a) was recovered from ER 14 at approximately 42 cm BS. Apparently it had not been completed. The point measured 4.5 cm in length and 3.5 cm in width. One side was notched and the base was flat. These point types would place the occupation in either the Plains Woodland or Plains Village period. However, the radiocarbon data from levels C/D in Area 2 indicates a Plains Woodland date.

It should be noted that the occupation consisted of only 50% Kay County with Worland chert comprising 35% of the total sample. Keokuk, Tahlequah, Woodford, Neva, and unidentified specimens made up the remainder of the sample.

Summary

The most significant characteristics of the area are the presence

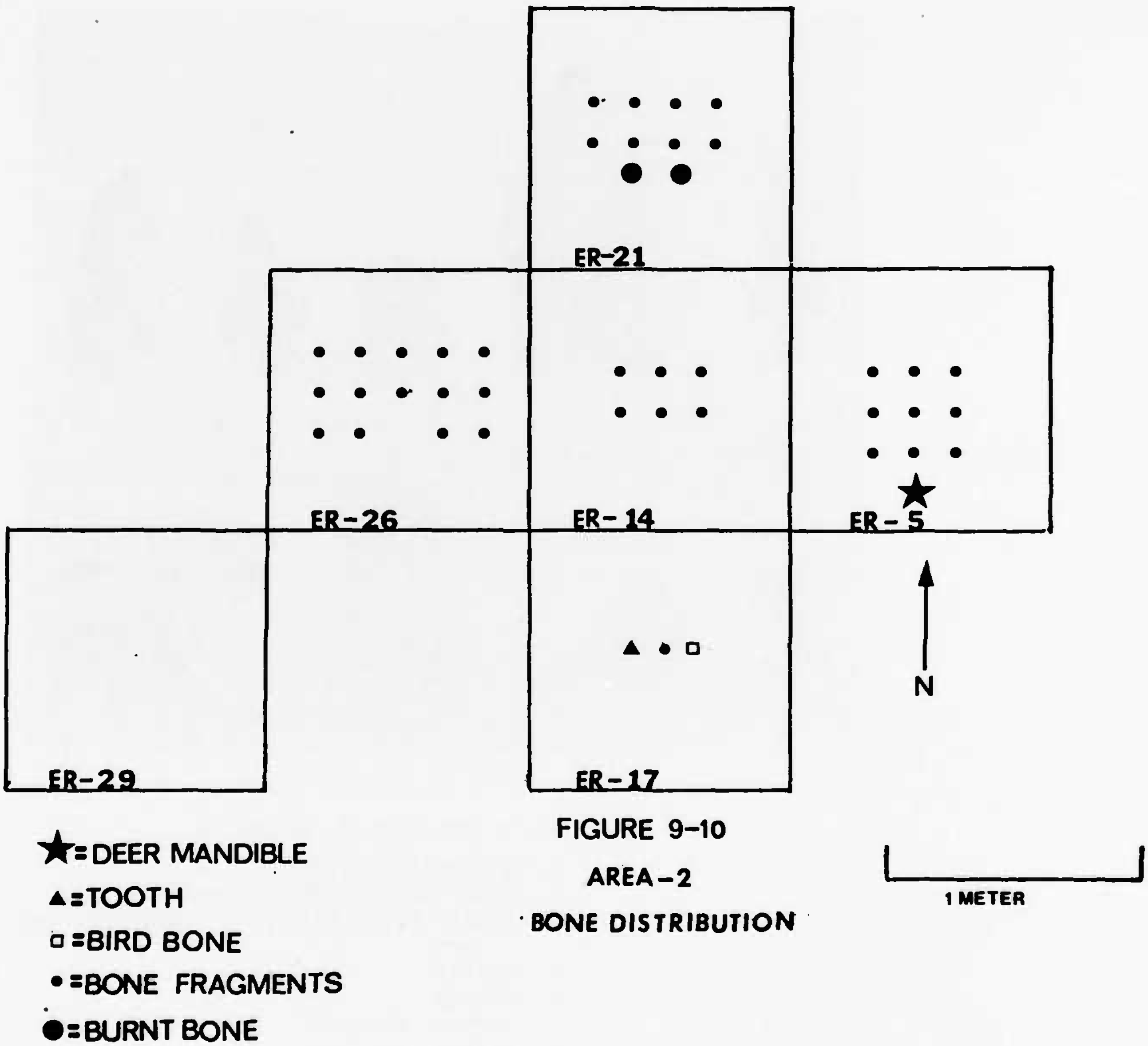


FIGURE 9-10

AREA-2

BONE DISTRIBUTION

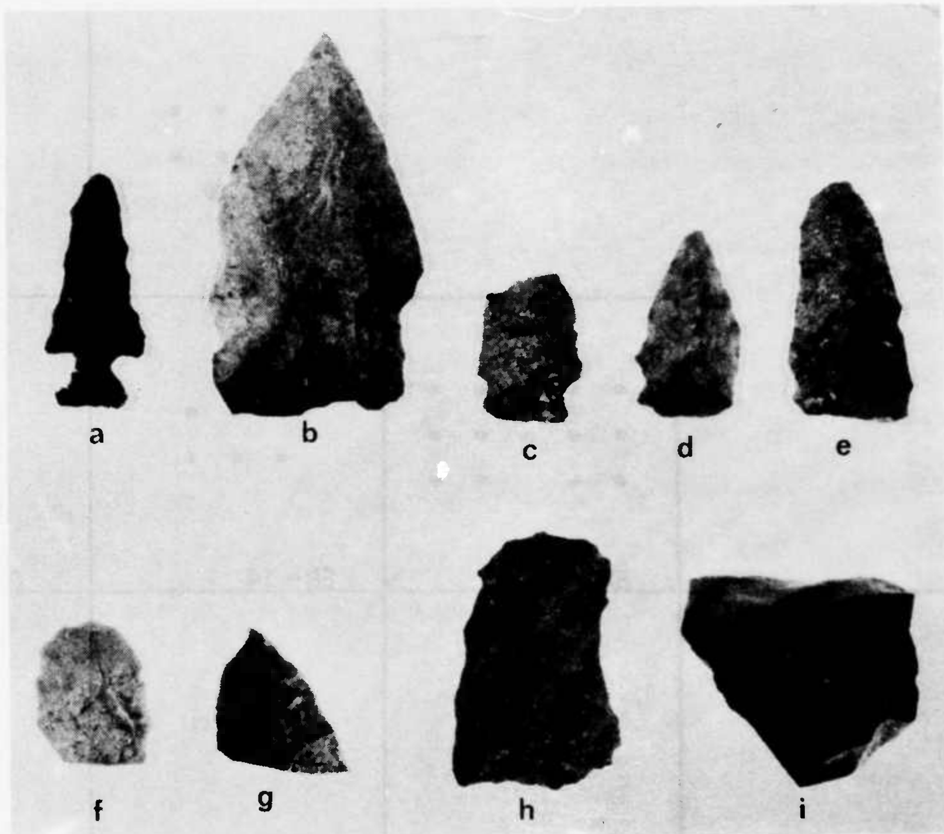


Figure 9-11. Tools from Area 2, 34 Os-155

a. projectile point
b. projectile point, unidentified type
c. broken projectile point, unidentified type
d. biface
e. biface
f. biface, fragment
g. biface, fragment
h. uniface, side scraper
i. core

(Scale: a=2.8 cm)

of an archeological feature and a relatively wide range of tools which imply a wide spectrum of activities. These items include burnt sandstone, burnt clay, ground stone fragments, a percussion cobble, pieces of possible pigment stone in addition to bifaces, cuniform gravers, and retouched flakes. As a consequence of the limited horizontal exposure of the artifact concentration, it could not be determined adequately if the exposed area represented the central activity area of the site or only a portion of a more extensive occupation.

It is maintained that the cultural material recovered in Area 2 is an extended single occupation within the Plains Woodland period. Although the deposit has been disturbed, the artifacts are apparently concentrated within levels B and C. In addition, the frequency of the raw material types does not shift significantly through time, supporting the extended or related status of the occupation.

ER 12, Os-155

This unit was placed approximately 120 meters north of Area 2 upon the alluvial terrace (Figure 6-3). The unit was excavated to 60 cm BS. Only one artifact, a tertiary Keokuk flake, was recovered. Further work was not conducted.

Area 3, Os-155

The excavation of 11 one-by-one meter squares in Area 3 produced 656 artifacts (Tables 9-15 to 9-18). Their distribution appears in Figure 9-12.

Artifact Distribution

In many respects, the spatial configurations and the material

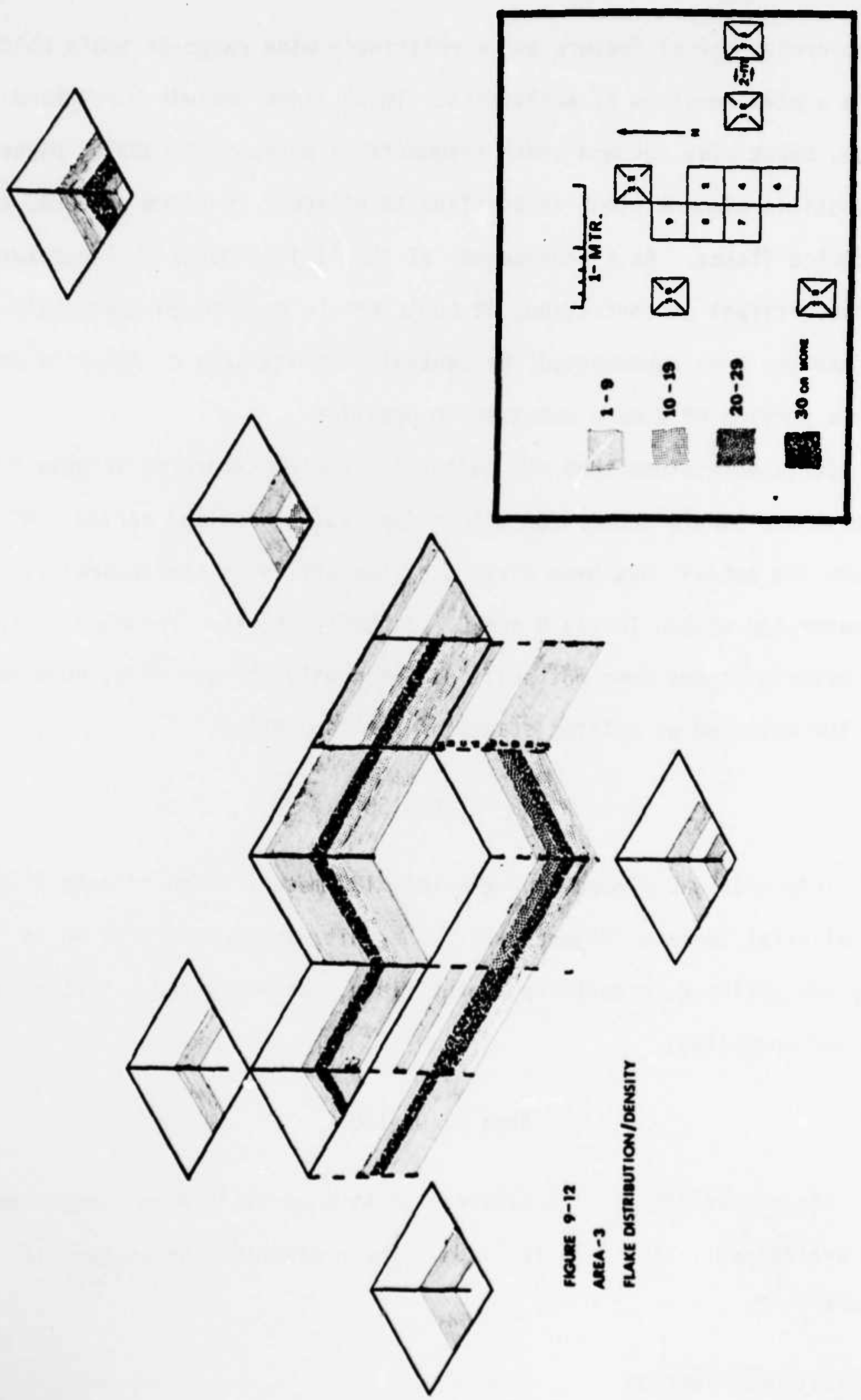


FIGURE 9-12
AREA-3
FLAKE DISTRIBUTION/DENSITY

TABLE 9-15

LITHIC DEBITAGE AND DEBRIS (Os-155, Area 3)
(by material type)

	Kay County (1)	Kay Gravel (2)	Keokuk (3)	Worland (4)	Talequah (5)	Woodford (6)	Neva (7)	Other (8)	Kay County (9)	
Primary	4	-	-	-	-	-	-	-	-	4 (1.0%)
Secondary	38	-	1	-	-	-	-	-	-	39 (6.4%)
Tertiary	189	1	3	-	-	-	3	3	-	199 (32.7%)
Debris	328	1	6	2	1	-	4	14	5	361 (59.4%)
Heat Spall	4	-	-	-	-	-	-	-	1	5 (.8%)
	563 (92.6%)	2 (.3%)	10 (1.6%)	2 (.3%)	1 (.2%)	-	7 (1.2%)	17 (2.8%)	6 (.07%)	608 (100%)

TABLE 9-16

LITHIC TOOLS (Os-155, Area 3)
(by material type)

	1	2	3	4	5	6	7	8	9	
Projectile Point	-	-	1	1	-	-	-	-	-	2 (5.6%)
Biface	5	-	1	-	-	-	-	-	-	6 (16.6%)
Uniface	9	-	1	-	-	-	-	-	-	10 (27.8%)
Graver	2	-	-	-	-	-	-	-	-	2 (5.6%)
Utilized Flake	15	-	1	-	-	-	-	-	-	16 (44.4%)
Core	-	-	-	-	-	-	-	-	-	-
	31		4	1						136 (100.0%)

TABLE 9-17

EDGE DAMAGE (Os-155, Area 3)
(by material type)

	1	2	3	4	5	6	7	8	9	
Scraper/Soft	12	-	-	-	-	-	-	-	-	12 (35.3%)
Scraper/Hard	7	-	2	-	-	-	-	-	-	9 (26.5%)
Knife-Chopper/Soft	3	-	1	1	-	-	-	-	-	5 (14.7%)
Knife-Chopper/Hard	5	-	1	-	-	-	-	-	-	6 (17.6%)
Graver	2	-	-	-	-	-	-	-	-	2 (5.9%)
	30 (88.2%)		4 (11.8%)	1 (2.9%)						34 (100.0%)

composition of the artifacts recovered from Area 3 replicate the pattern described in Area 1. As Figure 9-12 illustrates, the top 50 cm of the excavation contained a light scatter of cultural debris. The recovery of artifacts was so low, however, that only the six contiguous units were screened for artifacts in the top five levels.

TABLE 9-18

BONE (Os-155, Area 3)

Deer Bone	-
Bird Bone	-
Unidentified	12
Burnt	-
Total	12

Levels F, G, and H (60-80 cm BS) contained the highest percentage of artifacts (80.8%). However, in contrast to Area 1, the concentration did not appear to be as uniformly distributed within any one of these levels. Although the vertical dispersal of the artifacts may be a product of past depositional disturbance, it is suggested that the lateral displacement of the artifacts was not significant due to the rather marked boundaries between heavy and light densities of the cultural items.

The horizontal distribution of the cultural deposit appeared to have been fairly well defined by the completion of the first ten units

in the area. However, the easternmost unit (ER 25), the last one to be completed, encountered an equally dense deposit of cultural materials at the same elevation as those defined in the main testing area. Since ER 18 also contained a higher artifact count than any of the western units, it appears that the artifacts recovered in ER 25 represent a continuation of the occupational horizon.

As in Area 1, Area 3 did not provide any significant cultural features. Nevertheless, in an attempt to gain a further understanding of the possible presence of two specific activity areas within the same horizontal plane, the lithic debris and lithic tools have been plotted by unit (the bone fragments have not been plotted since all were recovered in the top two levels of ERs 6, 8, and 9). Only those artifacts in levels F, G, and H were included.

Referring to Figure 9-13, the most striking aspect is the high proportion of tertiary flakes in ERs 2 (39%), 7 (37.6%), 8 (86%), and 9 (52.1%). ER 25, the square with the highest artifact count, contained only 29% tertiary flakes, thereby indicating that the proportional distribution of the tertiary flakes was not a product of increased artifact density.

The distribution of the tools (Figure 9-14) also indicates a nonrandom placement of the implements. ER 25 contained half of the tools which displayed either the processing of "hard" materials, or continued use. Whichever the case, this eastern portion of the site appears to have been the focal point (at least of the exposed area) of past cultural activities. The combined distribution of the lithic debris and tools may allow one to infer tentatively that the main area of the testing was where the production of tools had occurred (due to the higher

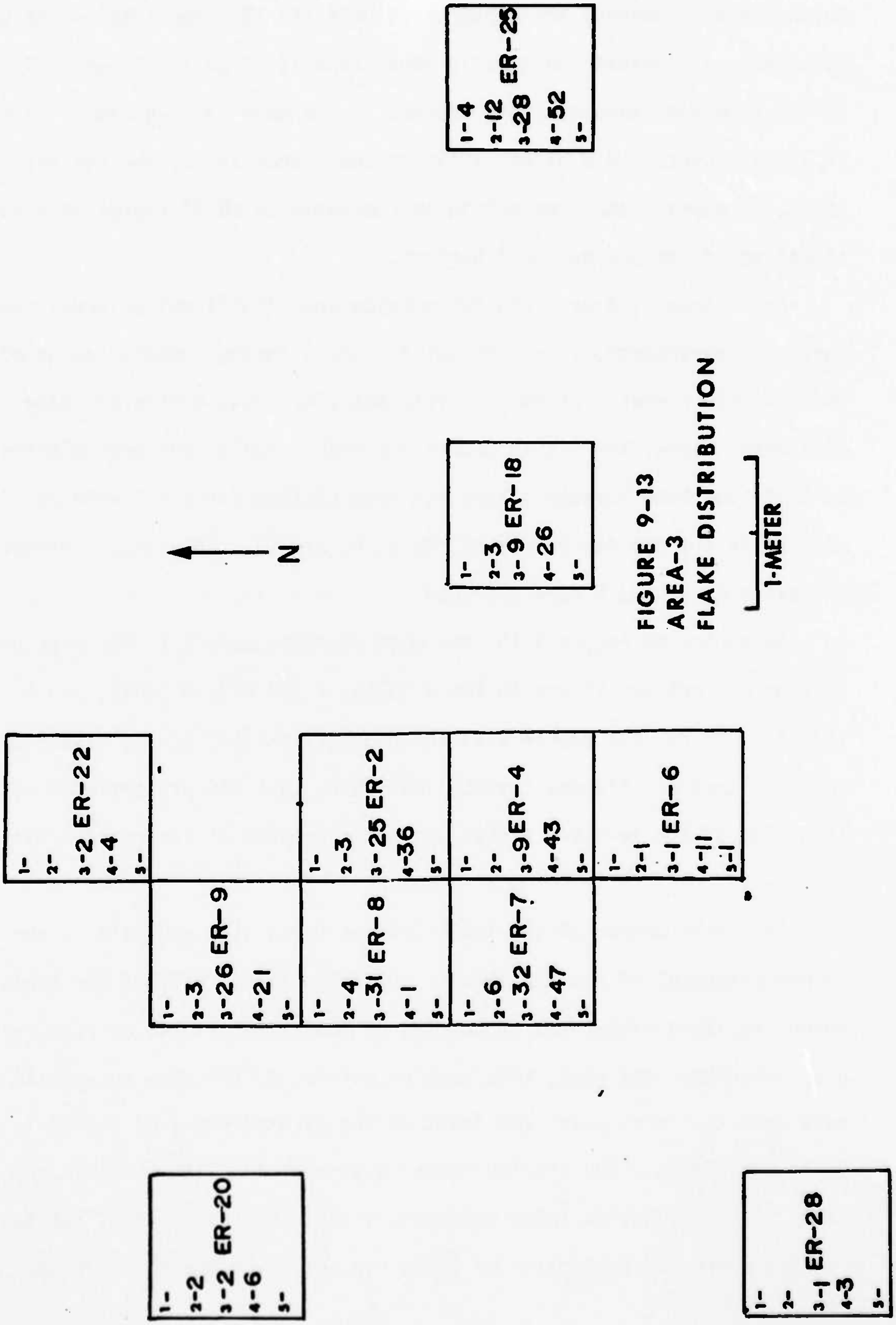


FIGURE 9-13
AREA-3
FLAKE DISTRIBUTION

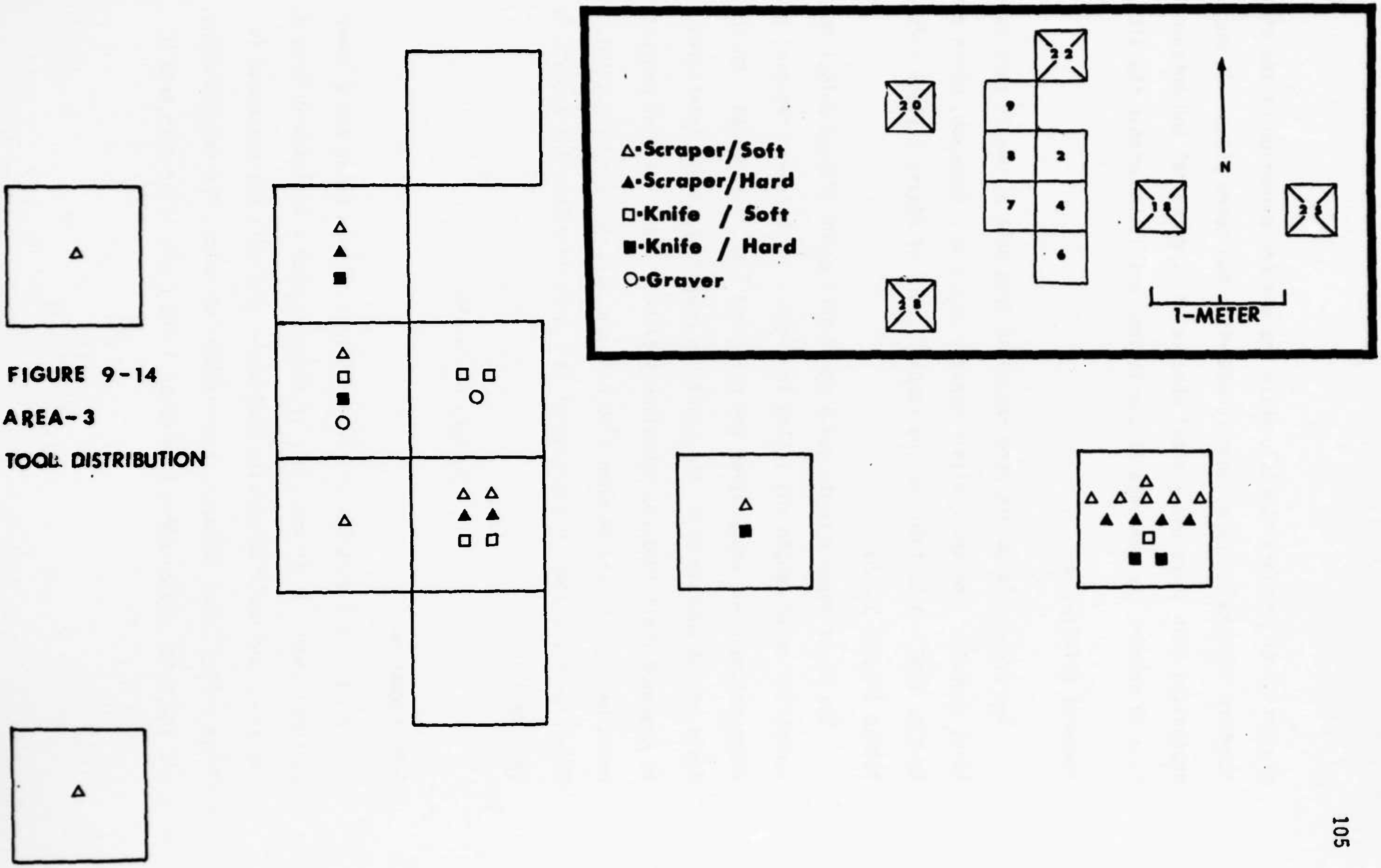


FIGURE 9-14
AREA-3
TOOL DISTRIBUTION

proportion of tertiary flakes), while the eastern extension of the site is where the processing of organic materials had taken place. It must be emphasized that there was a total absence of osteological and botanical data to support the presence of specialized activities within the site.

Temporal Affiliation

Two projectile points were recovered from Area 3, one in each cultural deposit. The upper lithic scatter produced a Sequoyah, which dates to A.D. 1000 - A.D. 1350 (Perino 1968:89), or, of Plains Village affiliation (Figure 9-15b).

The lower deposit contained a small dart point (Figure 9-15c) measuring 1.7 cm in length and 1.4 cm in width. The base was concave, the sides notched, and the body of the point had been resharpened. On the basis of the concave base, the point has been tentatively identified as an Edgewood (Bell 1958:20; Schneider 1967:34). This style of projectile point has been placed between 2000 B.C. and A.D. 500 (Bobalik 1978). This places the lower occupation of this area in either the Archaic or late Woodland.

Summary of Os-155

Site Formation

Areas 1 and 3 at Os-155 can be divided into an upper and a lower cultural zone. It is not clear if there is such a division in Area 2. The zones and their temporally diagnostic artifacts are presented in Table 9-19. Taken together, the radiocarbon dates, the geomorphology, and the point styles agree that Areas 1 and 2 are later than Area 3.

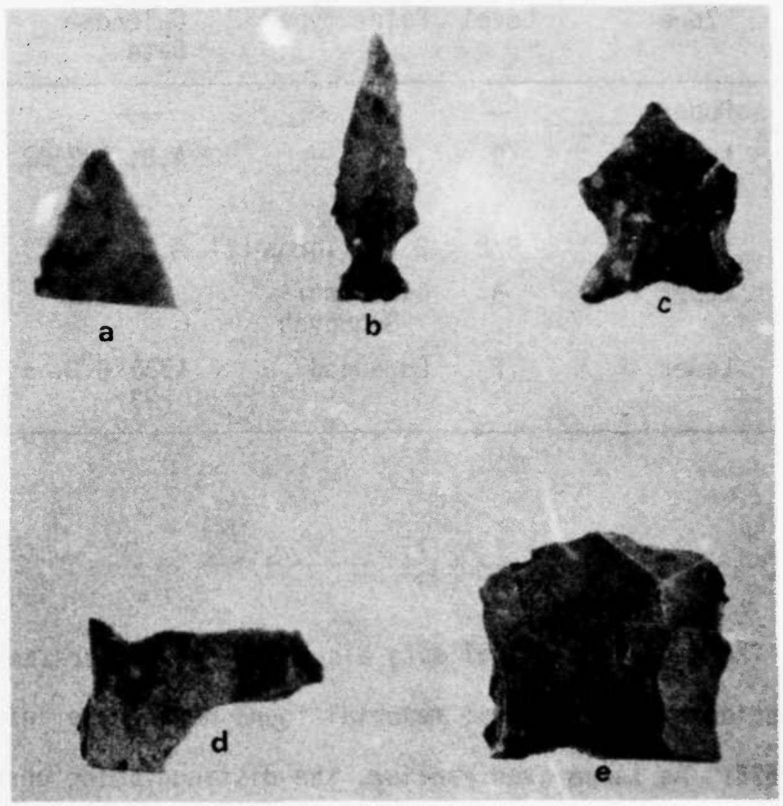


Figure 9-15. Tools from Area 3, 34 Os-155

a. biface, fragment
b. Sequoyah projectile point
c. Edgewood projectile point
d. graver
e. core

(Scale: b=2.5 cm)

TABLE 9-19

CULTURAL ZONES AT Os-155

Area	Zone	Level	Point Type	Calendar Date	Cultural Affiliation
1	Upper	--	--	--	?
	Lower	D	--	A.D. 192$\pm$82	Plains Woodland
2	Upper	-	--	--	?
	Lower	C/D	2 Scallorns (?)	A.D. 319$\pm$89	Plains Woodland
3	Upper	B	Scallorn/ Sequoyah	--	Plains Woodland/ Village (?)
	Lower	F	Edgewood	1235 B.C. $\pm$ 93	Late Archaic

The geomorphological data also aid in an understanding of the distribution of the cultural material found during the initial field work in 1976. As summarized earlier, the distinguishing characteristic of the collections from 1976 was their presence in a thin layer on the surface. It is now obvious that most of the material from the collection areas defined by Leehan were the result of erosion channels that cut down through the levels containing the material in Areas 1 and 2. The collections from around Area 3 were sparser and probably did not contain material from the lower zone of artifact concentration, since this zone was deeper.

Areal Differences

Major differences among the three areas, as seen from the artifact distribution tables, relate to 1) the greater variety of tools

and other cultural materials in Area 2; 2) a reduction in the frequency of Kay County chert in Area 2 and its replacement by large quantities of Worland and various amounts of other rare types; and 3) a disproportionately larger number of secondary flakes in Area 2.

Test 9-1. H_0: the frequency of flake type (1-3)* is independent of site area (1-3)

H_1: the two variables are dependent

	1	2	3	
Area 1	2 (2.9)	30 (33.6)	108 (103.6)	
2	7 (5.3)	83 (61.6)	167 (190.1)	
3	4 (4.9)	39 (56.8)	194 (175.3)	df=4

$\chi^2 = 19.3644$ Sig = .00067   reject H_0

*1=primary; 2=secondary; 3=tertiary

Test 9-2. H_0: the frequency of raw material type (1;2)* is independent of site area (1-3)

H_1: the two variables are dependent

	1	2	
Area 1	123 (91.8)	17 (48.2)	
2	65 (167.8)	191 (88.2)	
3	227 (155.4)	10 (81.6)	df=2

$\chi^2 = 309.6414$ Sig = .000001   reject H_0

(One missing observation)

*1=Kay County; 2=Other

Chi-square tests on the second two situations show that Area 2 differs significantly from Area 1 and Area 3 on the variables of material type and flake type. The relationship among the areas with respect to

their material content is in obvious contrast to the grouping on the basis of temporal criteria. Areas 1 and 2 are both placed in the Plains Woodland period and are distinct from each other, while Areas 1 and 3 from two different periods did not produce distinct assemblages.

A number of possibilities for the differences can be suggested: 1) there was a cultural continuity from the Late Archaic through the early part of the Late Woodland, what Vehik et al. (1979) calls Plains Woodland II, which underwent changes about A.D. 400. Area 2 could be representative of these transitional societies; 2) there were functional differences between Areas 2 and both 1 and 3; 3) the differences were caused by an occupation in Area 2 by a group with a different subsistence-settlement strategy; and 4) at least some of the differences are caused merely by the utilization of different raw materials.

To examine these questions and the others raised earlier (Chapter 6), the lithic data will be analyzed following two major alternative explanations: the differences among the areas are the result of functional differences in activities or differences in raw materials used. The results of these analyses will be summarized and related to the various questions in the conclusions of the report.

CHAPTER 10

LITHIC ANALYSIS OF Os-155

At the end of the last chapter, it was noted that preliminary comparison of the lithics from the three areas defined at Os-155 indicated that the two areas that were 1400 radiocarbon years apart were more similar than were the two areas that were much closer in date. This chapter further explores variation among the three areas and attempts to determine the cause of the defined variations. The analysis is divided into three major parts. The first examines the possibility that the variation in the three assemblages was due to differences in activities performed at each area--that is, to functional differences. In order to evaluate this hypothesis, the analytical categories of typological tool class, edge damage, and flake type were studied for each area.

The second part of the analysis examines how lithic material type affects typological tool class, edge damage, and flake type. It also examines whether the influence of lithic material contributes to the variation among the areas. In the third part of the analysis, an evaluation of current techniques of load application analysis is undertaken to determine whether this is a valid approach to determine lithic manufacturing technique. The relationships among site area, flake type, raw material, and flake thickness are examined by chi square and analysis of variance tests. Flake thickness, a crucial vairable in load application analyses conducted by prior research in the area, is considered as the dependent variable.

Functional Analysis

Typological Tool Classes

A qualitative examination of the different classes of tools in the site areas (Table 10-1) shows that, except for a lack of projectile points in Area 1, no cores in Area 3, and no points in the lower zone of Area 3, all classes appear in all areas. This indicates a similarity of activities from one area to the next.

On the other hand, other artifacts such as ground stone, hematite, limonite, and a percussion cobble are limited to Area 2, as is the only feature. The most bone, as well as deer antlers, also were found in Area 2.

In order to determine whether the distribution of the tool classes was independent of site area a chi square test was performed. Since the counts in a number of categories were very small and would have invalidated the use of the test, points were combined with bifaces and gravers and cores were eliminated from consideration. Artifacts from the upper levels of Areas 1 and 2 were excluded also. The test indicated that there was no difference among the site areas.

Edge Damage

Another way of looking at area differences is with the functional classification (Table 10-2 and Test 10-2). The edge damage reflects the general task the tools was used for.

The cells that contribute the most to the x^2 total are the "hard scraping" cells in Areas 2 and 3. In Area 2 there is a lower than expected frequency and in Area 3 a higher than expected frequency, perhaps

TABLE 10-1

TYPOLOGICAL CLASSIFICATION

	Area 1		Area 2	Area 3		Total	
1 Projectile Points	--		2	1	1**	3	1*
2 Bifaces/Biface Fragments	6	4*	13	5	1**	26	5*
3 Unifaces	4	6*	8	10		23	6*
4 Gravers	2		1	2		5	
5 Utilized Flakes	18	4*	30	16		66	4*
6 Cores	2		1	--		3	
Total	32	14*	55	34	2**	121	16*

*Artifacts recovered within the top 30 cms of Area 1.

**Artifacts recovered in the top 40 cms of Area 3.

Test 10-1 - H_0: the distribution of typological classes is independent of site area.

H_1: the two variables are dependent.

	Area 1	Area 2	Area 3
Point Biface	10(9.7)	13(11.8)	6(7.4)
Uniface	10(9.4)	8(11.4)	10(7.2)
Utilized Flake	22(22.8)	30(27.7)	16(17.4)

df = 4

$x^2 = 2.87$ Prob $(x^2) = > .50$ Accept H_0

TABLE 10-2

FUNCTIONAL CLASSIFICATION

	Area 1		Area 2	Area 3		Total	
1 Scraping/Soft (SS)	14	5*	26	12		53	5*
2 Scraping/Hard (SH)	6	1*	3	9		21	1*
3 Cutting/Chopping Soft (CS)	4	3*	7	4	1**	15	4*
4 Cutting/Chopping Hard (CH)	5	2*	13	5	1**	24	3*
5 Gravers (G)	2		1	2		5	
Total	31	11*	50	32	2**	113	13*

*Artifacts recovered within the top 30 cms of Area 1.

**Artifacts recovered in the top 40 cms of Area 3.

Note: Eleven artifacts contained edge damage which was attributed to platform preparation and therefore are not included.

Test 10-2 - H_0: the distribution of functional classes is independent of the site area.

H_1: the two variables are dependent.

Functional Class	Area 1	Area 2	Area 3
SS	14(13.9)	26(23.6)	12(14.4)
SH	6(4.8)	3(8.2)	9(5.0)
CS	4(4.0)	7(6.8)	4(4.2)
CH	5(6.2)	13(10.4)	5(6.4)

df = 6

$x^2 = 8.354$ Prob $(x^2) = > .10$ Accept H_0

indicating some difference in activities in the three areas. However, three expected values are less than five, making the results subject to doubt (Thomas 1976).

To test further for differences among activities in the areas, the edge damage classes were collapsed first into soft vs. hard categories and secondly into scraping vs. cutting. In this case the null hypothesis (H_0) was that the distribution of tasks involving different activities (processing soft vs. hard materials or using different kinds of tools in scraping vs. cutting/chopping) is independent of area. The null hypothesis was accepted in both cases (x^2 respectively 1.541 and 1.394), both below the significance level for two degrees of freedom.

In all tests, each site area exhibits a similar relative frequency of lithic tools, both functional and typological.

The examination of the relationship between typological form and edge damage (Table 10-3) shows some interesting trends but because of the small size of the sample it cannot be tested with chi square. Utilized flakes were used primarily for scraping and on soft material. This is generally true of unifaces as well, except in Area 3 where the scraping of hard materials was the most frequent type of activity. Bifaces were used predominantly for cutting hard materials. Of the four points, all bore traces of being used for cutting hard or soft materials, with one in Area 3 having been used for scraping a soft material. The two cores were used for heavy duty activity and the five gravers had use marks indicative of that activity.

Although the numbers are small, there does not seem to be any major differences among the site areas. It seems as if the same kind of choices were made in each area concerning which kind of tool was suitable

TABLE 10-3

RELATIONSHIP BETWEEN EDGE DAMAGE AND TOOL TYPE AT Os-155*

Typological Classification	Area 1 Functional Classification					Area 2 Functional Classification					Area 3 Functional Classification				
	SS	SH	CS	CH	G	SS	SH	CS	CH	G	SS	SH	CS	CH	G
Projectile Points								1	1		1		1		
Biface/Biface Fragments	4			5		2		1	10			1	1	4	
Unifaces	3	3	2			4					2	4	1	1	
Gravers					2					1					2
Utilized Flakes	12	4	5			20	3	5	2		9	4	2	1	
Core				2											

*Because of the small numbers, tools from all levels are included.

to which task. It can be noted also that all of the projectile points showed evidence of some other activity besides being used as a point. This seems unusual for such small points and should be considered in other studies to determine whether such functions are common on small point types.

To test further for the degreee of similarity of the lithic tools among the site areas, three one-way analysis of variance tests (TI Programmable 58) were calculated to determine if the mean length, width, and thickness values are equal (Tests 10-3 to 10-5).

Test 10-3 - length by area

Area 1 14 $\bar{x} = 2.193 \pm .559$

Area 2 22 $\bar{x} = 1.764 \pm .415$

Area 3 14 $\bar{x} = 1.772 \pm .112$

df = 2/416 F = 2.29943 F Prob = .111 Accept H_0

Test 10-4 - width by area

Area 1 $\bar{x} = 1.749 \pm .318$

Area 2 $\bar{x} = 1.631 \pm .237$

Area 3 $\bar{x} = 1.788 \pm .248$

df = 2/47 F = .4212 F Prob = .65876 Accept H_0

Test 10-5 - thickness by area

Area 1 $\bar{x} = .396 \pm .101$

Area 2 $\bar{x} = .337 \pm .023$

Area 3 $\bar{x} = .309 \pm .021$

df = 2/46 F = .5889 F Prob = .5591 Accept H_0

The purpose of a one-way analysis of variance test is to compare simultaneously the mean values of random samples, which have been drawn

from a normally distributed population, for equality. The null hypothesis states that $\mu_1 = \mu_2 = \ldots\mu_N$. Rejection of the hypothesis indicates that at least one of the sample means varies significantly from the estimated population mean (Ott 1977).

The null hypothesis for the three tests will therefore be that the mean values of length, width, and thickness are equal. It will be assumed that a rejection of the null hypothesis supports the inferences that either the raw material types influence the metric properties of the artifacts or that the lithic tools may be products of differing technological traditions. Only complete specimens were measured, excluding the four projectile points, due to their sample size. There were 14 items from Area 1, 22 from Area 2, and 12 from Area 3.

Each test accepts the null hypothesis and therefore indicates that neither raw material type nor the possible influence of varying technologies, if any, effect dramatically the metric attributes of the lithic tools. However, in many aspects this is misleading. An examination of the mean values and standard deviations of each test indicate that Area 1 contained the greatest amount of within-group variability. The standard deviations fluctuated between 18% to 25% of the mean value, thereby provoding a large margin of error for measuring the equality of means among the samples. Therefore, the results should be considered with caution. The question concerning the effects of differing raw material types on the mean values of the sample areas will be more fully examined in the following chapter.

Flake Type

In the past, various authors have used the relative frequency of primary, secondary, and tertiary flakes to infer the reduction sequences and technological strategies practices on sites (Skinner and Gallagher 1974; Gallagher and Bearden 1976, Henry 1977a, 1977b, 1978; Lynott 1978). Generally, it is maintained that a higher frequency of primary and secondary flakes implies the initial decortification of lithic nodules. A high frequency of secondary and tertiary elements reflects the processing of prepared cores, plants, and tools. In addition, it has been maintained that an absence or low frequency of primary and secondary flakes indicates that the raw materials used on the site had been carried in by the occupants.

Chi square test 9-2 indicates that Areas 1 and 3 contain a lower than expected frequency of primary and secondary flakes. Each area contains approximately 90% Kay County chert, a resource which is available only in north central Oklahoma. Therefore, it appears that the occupants of Areas 1 and 3 were transporting prepared nodules of chert into the site.

Area 2, on the other hand, contains a higher than expected frequency of secondary flakes. Also, typical Kay County makes up only 25% of the lithic resources. Even when the Kay County variety type #9 is combined, Kay County chert still only represents 51% of all lithic materials. Therefore, it would appear that the initial phase of decortification of chert nodules may have taken place in Area 2. If we are to assume that the principal purpose of decortification is to reduce the amount of energy required in transporting a usable chert nodule

from one area to another, then the higher frequency of secondary flakes should indicate that an exploitable lithic source was near the site area. However, an examination of the secondary flakes from Area 2 showed that 63% of the secondary flakes were of the Kay County variety. It is therefore concluded that the higher frequency of secondary flakes within itself is not significant. Apparently, considering the location of the resources which had been utilized (see Chapter 6), the occupants of all three areas were transporting the lithic materials into the site. Therefore, it is maintained that, on the basis of the distribution of flake type, the three areas experienced a similar range of prehistoric activities.

Summary of Functional Analysis

The chi square tests indicate that the relative frequency of the lithic tools among the the three areas is equal. It is therefore concluded that similar functional activities had taken place in each area. The one-way analysis of variance tentatively indicates that significant variations in the size of the tools was not present. Subsequently, it is assumed that the production of tools and the selection of usable flakes did not vary significantly from one area to another.

Effect of Material Type

The second part of the analysis will concentrate on the interactions between the kind of raw material and the variables typological tool class and functional class (edge damage) and flake type. This topic is examined for two reasons: 1) to see if there are differential selections

for typological or functional classes by material, and 2) if these show any differences among the site areas.

Typological Tool Classes

In order to examine the possibility that tools were selected from particular material types, a chi square analysis (Test 10-6) was performed on each area. Since numerous zero cells would result if each material type were considered, the comparison was made between Kay County chert (Types 1 and 2) and all the others. The chi square shows that material for the production of flakes and that for the production of tools came from the same population. The chi square for Area 3 could not be calculated because of the low expected in one cell.

Test 10-6 - H_0: *there* is *no* difference in the selection of material type for tools and for debris.

H_1: There is a difference.

Area 1

	Debris	Tools
Kay	356(355.2)	38(38.8)
Others	74(74.8)	9(8.2)

df = 1

x^2 = .105 Prob (x^2) = > .50 Accept H_0

Area 2

	Debris	Tools
Kay	103(101.6)	11(12.4)
Others	347(348.4)	44(42.5)

x^2 = .235 Prob (x^2) = > .50 Accept H_0

Test 10-6 (Cont.)

	Area 3	
	Debris	Tools
Kay	565(562.7)	31(33.3)
Others	43(45.3)	5(2.6)

Not calculated, expected less than 5.

Thus, the pattern of selection of material for tools and for debris is similar. One might expect that there is a relationship between area and material type selected for tools. To test this (Test 10-7), material types were collapsed into two--Kay and Other. The expectation of a significant relationship was met by the test.

Test 10-7 - H_0: the type of material used in the production of tools is independent of area.

H_1: the two variables are dependent.

	Area 1 Tools	Area 2 Tools	Area 3 Tools
Kay	37(26.5)	11(31.7)	31(20.8)
Others	9(19.4)	44(23.3)	5(15.2)

df = 2

$x^2 = 53.48$ Prob $(x^2) = .0000$ Reject H_0

However, one interesting observation can be made when examining the rare types: in all three areas there is a greater percentage of tools than of debris in the rare material types when tools are present (Table 10-4). This includes Kay County in Area 2, where it is in the minority.

It is possible that the examples of the rare material types were introduced into the site areas as tools or as almost finished blanks which were resharpened or flaked to a final form. The other material then would have been brought to the site in less finished form.

TABLE 10-4

PERCENTAGE OF DEBRIS AND TOOLS BY AREA IN Os-155

Area		Material Type									
		1	2	3	4	5	6	7	8	9	N
1	Lithic Debris	82.5	.2	7.7	1.6	2.1	-	-	3.3	.5	430
	Tools	80.5	-	8.7	4.4	6.5	-	-	-	-	46
2	Lithic Debris	16.7	6.1	5.8	36.0	.7	3.1	.9	2.0	28.7	450
	Tools	20.0	-	14.5	27.3	9.1	-	1.8	-	27.3	55
3	Lithic Debris	92.6	.3	1.6	.3	.2	-	1.2	2.8	.07	608
	Tools	86.1	-	11.1	2.8	-	-	-	-	-	36

Edge Damage

The next question considered might be whether the prehistoric occupants of the different areas selected different materials for specific functional tasks. Since the numbers of tools are small they are hard to interpret and chi square tests cannot be performed. One obvious trend is that all of the functional types most frequently appear on the most frequent material in an area (Table 10-5). Thus, there do not seem to be any obvious selective forces at work.

TABLE 10-5

SUMMARY OF FUNCTIONAL CATEGORIES GROUPED INTO TWO MATERIAL TYPES

	Area 1		Area 2		Area 3	
	Kay	Others	Kay	Others	Kay	Others
SS	15	4	5	21	12	-
SH	6	1	-	3	7	2
SC	6	1	-	7	3	2
CH	5	2	5	8	5	1
G	2	-	-	1	2	-

Flake Type

The last question to examine is whether flake type and material type have a dependent or independent relationship. Since both material types and flake type have dependent relationships with the variable area, one might expect material type and flake type to be dependent also. An examination of Test 10-8 demonstrates that this is not so; the two are independent of each other.

Test 10-8 - H_0: the frequency of flake type is independent of raw material.

H_1: the variables are dependent.

	Primary	Secondary	Tertiary
Kay	9(8.6)	103(104.4)	324(323.0)
Others	4(4.4)	55(53.6)	165(165.9)

df = 2

$\chi^2 = .12017$ Sig = .94168 Accept H_0

Summary of Material Type Analysis

Area 2 unquestionably contains a distinctively different assortment of raw material types. Worland, Neva, Keokuk, Woodford, and non-identifiable specimens comprise approximately 45% of the recovered materials. Typical Kay County chert constitutes only 25% of the sample. In contrast, Areas 1 and 3, respectively, contain 86% and 96% Kay County chert. Chi square tests demonstrated that, within the entire assemblage, the relative percentage of flake types was not dependent upon raw material types, in turn suggesting that a conscious selection of a particular raw material for the production of a specific tool/task did not occur. This suggestion is supported by other analyses on both the typological and functional classification of tools. However, this conclusion does not contribute greatly to an understanding of why different material is found in Area 2. This point will be returned to in the conclusion.

Load Application Analysis

This section is an attempt to evaluate the use of the load application analysis discussed earlier. Thickness was chosen as the metric variable to be analyzed since it is previously used in studies of northeastern Oklahoma archeology (Henry 1978).

Chi Square Analysis

A series of chi square tests (SPSS Crosstabs) was conducted to estimate the dependence or independence among the variables of site area, type of flake, raw material, and thickness of flake. In order to utilize flake thickness for a chi square test, the metric data were

collapsed into two discrete categories. Henry, Haynes, and Bradley's (1976:60) mean measurement of 1.2977 $\pm$ .264 mm for distinguishing pressure flakes from percussion flakes was provisionally accepted, since it is used in various other studies (e.g., Henry 1978:39). The artifacts which measured below 1.6 mm (1.2977 + 264) were placed in one category (thin); those above 1.7 mm were placed in another category (thick). The dimensions of only whole flakes were measured. (The reader should note that the lithic artifacts from two sites excavated by the 1976 project were reexamined and included in this analysis to increase the size of the sample from Area 2. They are recorded as ER 98 and 99 in Appendix).

The different lithic resources, other than Kay County chert, were not well represented in each site area; as a consequence, all varieties other than Kay County were collapsed into an "other" category (#2) in an effort to increase sample size and reduce the number of zero cells within the chi square contingency tables.

The variety of raw material #9, tentatively identified as weathered Kay County chert, was also placed into the "other" category. In contrast to the typical Kay County variety, a fine grained, grayish to pink chert, variety #9, was light to dark gray in color and grainier in structure. It was maintained that the removal of type #9 from the Kay County class was warranted, due to the qualitative differences between the two samples.

Finally, the intra-site comparisons in the chi square tests excluded the complete flakes recovered in the top three levels of Area 1 (23 items) and the top four levels of Area 3 (4 items). The purpose was to provide artifact samples which represented only one period of occupation from each area.

The first relationship that had to be evaluated was whether thickness was independent of site area. If they were dependent and it was concluded that the thickness of flakes serves as a measurement for distinguishing pressure flakes from percussion flakes, the proportional representation of flake thickness should allow one to infer forms of lithic production in different site areas, however they are not dependent.

Test 10-9 - H_0: thickness of flake is independent of site area 1-3.

H_1: the two variables are dependent.

Area	Thin	Thick
1	89(70.2)	51(69.8)
2	80(128.9)	177(128.1)
3	149(118.9)	88(118.0)

df = 2

x^2 = 41.4379 Sig = .000001 Reject H_0

The next set of tests assesses whether other variables than manufacturing technique affect flake thickness. First, we need to test whether flake type affects thickness. Flake type and thickness are not independent. Apparently, therefore, the observed variability among the site areas may be a product of cultural activities (Test 10-10).

However, Area 2 contains only 25.4% of typical Key County chert, whereas Areas 1 and 3, respectively, contain 37.9% and 95.8%. Therefore, it might be asked whether the variability of flake thickness is not only a product of flake type but also of the type of raw material from which any type of flake was struck.

Test 10-10 - H_0: the frequency of flake type is independent of thickness.

H_1: the two variables are dependent.

	Primary	Secondary	Tertiary
Thin	1(6.5)	44(76.2)	273(235.2)
Thick	12(6.5)	108(75.8)	196(233.8)

df = 2

x^2 = 48.8910 Sig = .000001 Reject H_0

Comparing the actual to the expected values, Areas 1 and 3 exhibit a higher frequency of thin flakes (possibly pressure) than Area 2. Conversely, Area 2 contains a higher than expected frequency of thick flakes (possibly percussion). The demonstrated dependence between area and flake thickness may therefore be a consequence of different technological activities having occurred in Area 2 and Areas 1 and 3.

Assuming tentatively that the demonstrated dependence is a product of differing technological practices, one should therefore expect to observe different frequencies of flake types among the three areas. Chi square test 9-2 indicates that this was so.

Area 1 closely conforms to the expected values. In Area 3 a lower than expected frequency of secondary flakes occurs, as well as a higher proportion of tertiary elements. Area 2 displays the opposite trend. Therefore, the concomitant distribution of percussion and secondary flakes in Area 2, as well as pressure flakes and tertiary flakes in Area 3, lends additional support for inferring that different technological and possibly cultural activities had occurred, in particular, in Areas 2 and 3.

Test 10-11 - H_0: the frequency of thin/thick flakes is independent of raw material.

H_1: the variables are dependent.

	Thin	Thick
Kay	240(207.2)	173(205.8)
Others	78(110.8)	143(110.2)

df = 1

^{2} = 29.9809 Sig = .000001 Reject H_0

Test 10-11 demonstrates that part of the variability in flake thickness is dependent upon the lithic resources present. Apparently, the raw material type also influences the thickness of the manufactured flakes.

Since it has already been demonstrated (in Test 10-8) that raw material and flake type are independent of each other, one can begin to suspect that the variation of flake thickness by site area is dependent upon both the types of flakes present (primary, secondary, and tertiary flakes) and the type of raw material from which the flakes were struck. Therefore, flake thickness should not be used to distinguish pressure and percussion flakes unless both the material variable and the flake type variable is controlled.

Analysis of Variance

The apparent dependent relationship between thickness of flake and raw material type was further investigated through an analysis of variance (SPSS Oneway, ANOVA). Thickness was treated as the dependent variable with area, flake, and raw material type as the independent variables. The same classificatory schema as used in the chi square tests was retained for the independent variables, while the dependent variable was returned to a metric format.

In the following one-way analysis of variance tests, the null hypothesis will be that the mean thickness of each sample population (Areas 1, 2, and 3) is equal. The alternate hypothesis will be that at least one of the mean values is unequal.

The first test collapses the flake types into one category and compares their overall mean value by site area:

Test 10-12 - the mean thickness of flakes by area.

	N	x	S	
				df = 2/658
Area 1	163	.147	.09	F - ratio = 32.9019
Area 2	257	.255	.18	F - prob = .00001
Area 3	241	.167	.14	Reject H_0

The mean values of flakes by area vary significantly. However, in that the one-way test signifies only that at least one of the mean values is not equal, T-tests were calculated among the mean values to determine which area(s) varied significantly from one another. The results demonstrated that each area varies significantly from the others at a .0001 level.

To determine if the variability in raw material types contained within the entire flake sample were largely responsible for rejection of the null hypothesis, the test was rerun with only the flakes produced on Kay County cherts to hold raw material variability constant.

Test 10-13 - mean thickness of Kay County flakes by area.

	N	$\overline{X}$	S	
Area 1	355	.0593	.094	df = 2/1029
Area 2	113	.133	.157	F - ratio = 16.8360

Test 10-13 (Cont.)

	N	$\bar{X}$	S	
Area 3	564	.070	.127	F - prop = .00001
				Reject H_0

Again, the hypothesis was rejected; at least one of the mean values varies significantly. Because the entire sample was composed of only Kay County chert, the estimated pooled variance was employed for testing the results of the T-tests. Area 2 varied from Areas 1 and 3 at a .0001 level of significance. Areas 1 and 3 did not display significant variability (.164). Thus, with the raw material being held constant, variability between Area 2 and Areas 1 and 3 continues to persist. However, under the above conditions, the mean values of all flakes in Areas 1 and 3, the areas with the highest frequencies of Kay County chert, were equal.

Chi square Test 9-2 indicated that Area 2 had displayed the greatest amount of non-conformity in the distribution of flake types by area. One-way Test 10-14 compares the mean thickness of the three flake types collectively to see if their mean values vary significantly from one another.

Test 10-14 - mean thickness by flake type.

	N	$\bar{X}$	S	
Type 1	13	.296	.146	df = 2/658
Type 2	158	.275	.219	F - ratio = 33.1888
Type 3	490	.169	.120	F - prob = .00001
				Reject H_0

The rejection of the null hypothesis indicates that the thickness of flake types varies significantly. As a result, three additional one-way tests were conducted in which the flake type was held constant while all the raw material types were collapsed into one sample. If the principal source of variation in flake thickness is the stage of reduction in which the flake was produced, then the mean values of each flake type should be equal for all three areas.

Test 10-15 - mean thickness of primary flakes by area.

	N	$\bar{X}$	S	
Area 1	2	.195	.007	df = 2/10
Area 2	7	.278	.161	F - ratio = 1.214
Area 3	4	.377	.378	F - prob = .3373
				Accept H_0

The sample means are equal.

Test 10-16 - mean thickness of secondary flakes by area.

	N	$\bar{X}$	S	
Area 1	36	.196	.114	df = 2/155
Area 2	83	.333	.263	F - ratio = 6.72798
Area 3	39	.226	.140	F - prob = .0016
				Reject H_0

Test 10-17 - mean thickness of tertiary flakes by area.

	N	$\bar{X}$	S	
Area 1	125	.132	.079	df = 2/487
Area 2	167	.215	.111	F - ratio = 22.0622
Area 3	198	.152	.136	F - prob = .00001
				Reject H_0

The acceptance of H_0 for primary flakes is probably due to the large standard deviations; this, in turn, is partially a product of the extremely small sample size. The T-tests for secondary flakes show that Area 2 varies from Areas 1 and 3 at the .0001 level. The variance between Areas 1 and 3 is insignificant (.218). With the tertiary sample, all areas proved to be significantly different; 1 vs 2, 3 = .0001, 1 vs 3 = .008.

Thus far, holding one variable constant has only cancelled the variability in one test--primary flakes, and that was probably a reflection of sample size. However, at least the following proposition can be set forth; if raw material does not contribute to the variability in flake thickness, than a one-way test controlling for raw material type and flake type should display the same amount of variability as when one flake type was run with all material types. Conversely, the acceptance of the hypothesis that the mean thickness of flakes from all three areas will be equal when raw material type and flake type are held constant, would demonstrate that raw material does contribute significantly to the variability in flake thickness. Kay County chert was selected for the following tests:

Test 10-18 - mean thickness of secondary flakes by area (Kay County).

	N	$\bar{X}$	S	
Area 1	31	.196	.120	df = 2/100
Area 2	34	.295	.157	F - ratio = 4.18424
Area 3	38	.227	.142	F - prob = .0180
				Accept H_0

Test 10-19 - mean thickness of tertiary flakes by area (Kay County).

	N	$\bar{X}$	S	
Area 1	107	.134	.083	df = 2/321
Area 2	28	.151	.085	F - ratio = 1.00710
Area 3	189	.154	.138	F - prob = .3664
				Accept H_0

The tests' results further suggest that the thickness of a flake is also dependent upon the type of raw material from which it was produced. By controlling for the two principal sources of variability, flake type, and raw material type, the variance in flake thickness among the three areas becomes insignificant. The proposition can be further tested by comparing the mean thickness of tertiary flakes among the remaining (non-Kay County) raw material types. If raw material variability is indeed significant, then the sample means of the three areas should not be equal.

Test 10-20 - mean thickness of tertiary flakes by area (Others).

	N	$\bar{X}$	S	
Area 1	18	.117	.051	df = 2/162
Area 2	138	.227	.112	F - ratio = 13.2860
Area 3	9	.105	.073	F - prob = .00001
				Reject H_0

The rejection of H_0 lends additional support to the significance of resource variability. However, an examination of the T-tests indicates that Areas 2 and 3, and 1 and 3 are significantly different, while Areas 1 and 2 contain similar values. In that Area 1 contains the second

largest sample, and because it compares favorably (equally) with the largest sample from Area 2, it may be argued that the deviation represented in sample 3 may be only a reflection of an inadequate sample.

To further test the proposition, the second largest representative sample by area, Keokuk chert, was tested under similar conditions.

Test 10-21 - mean thickness of tertiary flakes by area (Keokuk)

	N	$\overline{X}$	S	
Area 1	2	.131	.059	df = 2/19
Area 2	11	.129	.057	F - ratio = .853013
Area 3	3	.180	.087	F - prob = .4418
				Accept H_0

Again, the results can be questioned because of the extremely small samples. Nevertheless, the acceptance of the null hypothesis lends additional support to the proposition that the raw material significantly effects the thickness of flakes.

In review, comparing the sample means has demonstrated that significant variations do exist among the site areas; generally, Area 2 has consistently differed from Areas 1 and 3. Various attempts have been made to control for the expressed variability among the site areas. Repeated tests have demonstrated that flake type and raw material type account for the greatest amount of variance. When either one of the two principal variables is held constant, the remaining variable continues to affect significantly the mean values of the samples. However, when both are held constant, the intra-site variability becomes insignificant.

A two-way analysis of variance (SPSS ANOVA) was executed to measure the amount of interaction between the two variables. The purpose of the investigation was to determine if the expressed variability was due to a combined interaction of flake type and raw material type on particular classes of the lithic assemblage; or, did the two variables systematically and individually influence the thickness of each flake and raw material type?

An examination of the sum of squares in Test 10-22 indicates that the two-way interactions account for only 0.28% $(\frac{SSAB}{SSTOTAL})$ of the variance. The main effects collectively account for 13.8% $(\frac{SSME}{SST})$ of the variability in thickness. Individually, flake type accounts for 9.1% $(\frac{SSA}{SST})$ and raw material for 4.6% $(\frac{SSB}{SST})$. Because the two-way interactions explain so little of the variability, the actual effects may be a product of error; therefore, by combining the SSAB with the SSE (Residual), the amount of variability explained by the combined effects of flake type and raw material type is reduced to 13.7%. The absence of two-way interaction between the two variables indicates that the effects apply to each of the respective subclassifications; raw material affects the thickness of each flake type and vice-versa.

Finally, an examination of the multiple classification analysis table (Table 10-6), indicates that among the flake types, the primary variety exhibits the greatest amount of variation from the grand mean, +.09992647.

The tertiary elements express the least amount of deviation from the mean, -.02818787. Consideration of the raw material types demonstrates that the homogenous sample of Kay County chert provides the least amount of variation, -.02430350. Conversely, the collapsed category of raw

Test 10-22 - H_0: the interaction of flake type and raw material type significantly affects flake thickness.

H_1: the interaction is insignificant.

Source of Variation	Sum of Squares (SS)	df	Mean Square	F	Sig. of F
Main Effects	2.2502804	3	.75009346	34.973	.000001
Flake Type (A)	1.4914980	2	.74574900	34.770	.000001
Raw Material Type (B)	.74541837	1	.74541837	34.775	.000001
2-Way Interactions	.04629934	2	.023149967	1.079	.34042
Flake Type/Raw Material	.046299603	2	.023149800	1.079	.34042
Explained	2.2966803	5	.45931602	21.415	.000001
Residual	14.026906	654	.02147867		
Total	16.323486	659	.024770055		

material types almost triples the value of deviation exhibited by the Kay County variety, +.4730487.

TABLE 10-6

MULTIPLE CLASSIFICATION ANALYSIS

Grand Mean = .1964849

Variable and Category	No. of Cases	Deviations Unadjusted	Deviations Adjusted for Independents
Flake Type			
1	13	.09992647	.10217610
2	158	.07901758	.07839948
3	489	-.02818787	-.02804798
		ETA = .304	BETA = .302
Raw Material			
1	436	-.02430350	-.02409071
2	224	.04730487	.04689068
		ETA = .216	BETA = .214
Multiple R Squared			.138
Multiple R			.371

Summary of Load Application Analysis

Chi square test 10-11 indicated that the distribution of flakes above and below 1.6 mm in thickness was dependent on site area. If one were to accept the experimental results of Henry et al. (1976), this would suggest that Area 2 contained a greater frequency of

percussion flakes than either Areas 1 or 3. On the basis of such information one could further infer that a different form of lithic production had been exercised in Area 2.

Henry and his co-authors, in their discussion of load application experiments, cautioned that these results were only tentative and that additional experiments should be conducted to determine if the mean value of thickness would vary by raw material type alone. In response to their suggestions, an analysis of variance as a complement to the earlier chi square tests was conducted to measure raw material variability. Although the results are tentative at best, due to unequal samples, they do indicate that the mean thickness of tertiary and secondary flakes vary by raw material type and raw material type accounts for 4.6% of the total variance in the thickness. It can therefore be concluded that an across the board application of a single measurement on unidentified raw material could lead to faulty conclusions. Subsequently, the expressed variance in flake thickness between Area 2 and Areas 1 and 3 may be related only to the source of raw material and not to the form of flake detachment.

Summary of Lithic Analysis

The analysis of the lithics from Os-155 has explored the functional and technological variation among the three occupation areas. The results of these analyses will be used in the next chapter to evaluate the various questions that were raised earlier about the possible reasons for the similarities and differences among the areas.

CHAPTER 11

SUMMARY AND CONCLUSIONS

This phase of the Candy Creek cultural resource assessment tested two sites, Os-149 and Os-153, that could not be tested earlier due to lack of land owner permission. It also conducted more extensive investigations of Os-155, where prior testing had indicated the presence of extensive, though sparse, deposits.

Os-149 and Os-153

Very little can be said about these two sites. Both seem to date post-Archaic contexts and the presence of ceramics at one of them suggests it may have had a more extensive occupation than would a transient camp. However, the testing demonstrated that sub-surface deposits were minimal, and the sites failed to produce sufficient information to support a detailed analysis of their date or functions.

Os-155

The 1976 program and the first phase of the 1979 project defined a site with a medium density of cultural material and a number of discrete cultural areas. Several loci with high density of tools and a low density of flakes on the surface probably resulted from erosional events. The second phase of the 1979 project was devoted to defining the cultural areas and gathering sufficient information to determine their similarities and differences, the reasons for these similarities and differences, and the geomorphological processes at work at the site.

Stratigraphy

The geomorphological study, in conjunction with the radiocarbon dates, established at least two temporally distinct occupations at Os-155. The following sequence of events seems to have occurred. There was a period of alluvial deposition starting before 6000 B.C. (Unit C). At some later time this unit underwent downcutting by the nearby stream. In this channel (or channels) yellowish sediments (Unit B) were deposited. Probably before about A.D. 600, the Copan paleosol began to be formed, on top of both Units B and C. Later, alluvial sediment, Unit A, was deposited over the paleosol in many areas of the valley. The downcutting of the modern stream channel and the erosion channels through the valley soils occurred next.

Area 3 of the site, with a C-14 date of 1235 B.C., was deposited in Unit C before the paleosol began developing. On the basis of artifact typology and absolute date this area can be assigned to the Late Archaic. Areas 1 and 2, averaging about A.D. 250 in date, seem to have been deposited either immediately before the paleosol or at the very beginning of its development. Artifact types and the date assign this occupation to the Plains Woodland period. If these two areas of the site were deposited before the paleosol formed, then, since these areas are over Unit B sediments, the latter had to have been deposited by at least A.D. 250.

The Unit A sediments do contain some artifacts possibly dating after A.D. 1000, in the Plains Village period. It is unknown when the erosional episode that cut down through the sediments containing the Areas 1 and 2 occupations occurred. However, the cross-section through the site makes it clear that erosional channels did dissect the site. The

water which created these channels probably removed the smaller, lighter cultural material, leaving behind a higher proportion of larger items, such as the tools collected in 1976.

The stratigraphic analysis demonstrated that two distinct occupational levels occur at the site. Area 3 could be dated to the Late Archaic period and was under the paleosol. Areas 1 and 2 were probably in the paleosol and date to the Plains Woodland, about 1500 years later. Although the radiocarbon date from Area 1 is older than that from Area 2 and the latter is slightly higher, the sigma range for the dates overlap and therefore one cannot exclude the possibility that they were deposited by the same occupation. However, the distance which separated them implied that they were at least distinct segments of the site, if not different occupations. Thus, all three areas were considered as separate units for the analysis of the nature of the occupations.

Nature of the Deposits

Various tests conducted on the data demonstrated that there were indeed differences among the areas. Briefly, Area 2 was distinct from the other areas in terms of types of cultural material, the presence of a feature, different proportions of raw material types, and a greater proportionate number of secondary flakes. These differences need to be explained. In particular, the reason that Area 2 differs from Area 1, which was at least approximately of the same time period, must be examined.

One of the most obvious differences between Area 2 and the other two areas is the relatively low frequency of Kay County chert in 2 and the concommitantly high frequency of cherts from the east and northeast of the Candy region.

One possible cause of the differences among the site areas is a change in cultural tradition, such as from the Archaic to the Woodland. However, this has been eliminated by the stratigraphy. However, it is possible that another type of cultural change occurred--a shift in the site's occupants from a group affiliated with one areal tradition to a group affiliated with a different areal tradition. Since the Candy Creek region is barren of raw material sources, it should be possible to use the source areas to identify the areal affiliation of individual occupations. Such an analysis, however, may obviously be confounded by trade.

The range utilized by the occupants of the site could include: 1) source areas to the west, 2) source areas to the east, 3) both eastern and western source areas, or 4) no source areas. The evidence might suggest that the group had its primary affiliations to one or the other direction, or the evidence might be inconclusive.

The raw material assemblage from Areas 1 and 2 seem to indicat a primarily western affiliation, while that from Area 2 is primarily eastern. The non-exclusivity of either type of material indicates that some trade or other interaction was occurring with both directions. Thus, the difference in raw material among the areas could be due to an occupation by populations with different primary areal affiliations. Other differences, noted above, might possibly also be explained by the same factor, assuming that the material cultural traditions of the different geographic areas varied somewhat.

On the other hand, the differences among the site areas might be explained by changes in function from one to the other. This leads into the larger question of whether it is possible to identify the functions performed at the site areas.

An examination of the tools both from a typological and a functional point of view demonstrated that, basically, the same set of activities was performed at all site areas. Scraping and cutting/chopping of both hard and soft materials, with the scraping of soft materials being predominant, occurred in all three areas. The analysis did not distinguish between edge damage caused by plant or animal material--both probably were used but in what proportions is not known. Hunting is probably represented by the projectile points, although the edge damage on all these items leads one to question if this was their primary function and they were later reused, or whether they were never really intended to function as "points." Other activities such as graving and tool manufacturing are also present. Only Area 2 has direct evidence of plant preparation, in the form of broken grinding stones. The sandstone feature in this same area undoubtedly represents a hearth.

The analysis of the flake types also points to a possible difference: a higher proportion of secondary flakes in Area 2. This could indicate processing of raw material that was less prepared at the source. While this may be a valid interpretation, the analysis indicated that all areas were importing material in varying degrees of preparedness. Thus, this difference may indicate more about material procurement systems than about functional differences among the site areas.

All in all, there does not seem to be many functional differences among the three site areas. All seem to be generalized hunting and gathering camps. The increased number of different kinds of cultural material in Area 2 may indicate only a longer occupation there than elsewhere. Yellen (1977), Schiffer (1975), and Cheek et al. (1977) have all pointed out that the longer a site is occupied the more likely it is to produce

a greater variety of artifacts, since the longer a site is occupied the more likely it is that different tasks will be performed.

The intensity of the site's occupation can also be measured by the percentage of tools in the lithic assemblage. This percentage is similar at Areas 1 and 2--5.1% and 5.2%, respectively. The proportion of tools is much lower in Area 3--2.4%. These figures can be interpreted to suggest that Area 3 was much less intensively occupied than Area 1, and Area 1, based on the greater variety of material in Area 2, was occupied less intensively than Area 2. However, none of the areas could be interpreted as being a base camp or other long term camp, since the density of material is low in all areas.

Overall, it appears that all three site areas are temporary campsites, "transient camps," which were occupied for differing amounts of time. None seem to be specialized for one particular function but many basic subsistence and maintenance activities were carried out.

The Archaic camp matches the characteristics predicted for such a site based on a survey of the archeology of the surrounding region. It can be conceptualized as a transient camp occupied during part of a seasonal round, and utilized by an egalitarian band.

The Plains Woodland camps were predicted to be slightly different: they were to be just one segment of a series of specialized sites. It is true that there is no evidence of horticulture at these areas, and therefore if horticulture was practiced by all groups in this tradition, Areas 1 and 2 would be "specialized" camps. Floral remains do not exist nor do faunal elements that are good seasonal indicators. Thus, the season of occupation, an aid in defining site function, is unknown. Additionally,

there is no evidence that these sites are "specialized" for one or another extractive task. Rather, they seem to be basically similar to the earlier Archaic camp. The greater intensity of occupation at the two later areas may reflect a more efficient energy exploitation strategy by these later peoples.

Although most of the variation among the site areas seems to be explained by their exploitation of different raw materials and the length of occupation of the particular area, one further possible explanatory principle must be mentioned: did environmental change cause the variation among areas? Hall and Henry have presented evidence of a minor drying trend at about A.D. 800-900. Obviously, this is too late to have effected the three areas under consideration. It is possible, however, that the beginning of the Copan paleosol may signal an as yet undefined climatic change which allowed longer occupation in the Candy area.

Summary

It is maintained that the variation which separates Area 2 from the other two areas is due to the exploitation of a different set of lithic resources, and any concommitant differences of areal cultural traditions, as well as by a longer occupation at that locus. Although it is only hypothetical at this stage, it is suggestive that the increasing intensity of use of the Candy area, as represented by these site areas and by those excavated by other projects, took place at about the same time as the beginning of the formation of the Copan paleosol. The possibility of a causal relationship should be explored further.

Conclusion

This project completed the excavation and evaluation of five occupations--one each at Os-149 and 153, and three at Os-155. Only those at Os-155 were sufficiently productive to allow meaningful analysis. One of these is the only excavated example of an Archaic site in the Candy region. The excavations also showed that excavation of small sites can provide very useful cultural information and that such sites are worthy of continued consideration in cultural resource management.

REFERENCES CITED

Baldwin, J. 1969. The Lawrence Site, Nw-6, a non-ceramic site in Nowata County, Oklahoma. Oklahoma River Basin Survey, Miscellaneous Report, No. 4, Norman.

Baldwin, J. 1970. The Lightening Creek Site, Nw-8, Nowata County, Oklahoma. Oklahoma River Basin Survey, Archaeological Site Report, No. 18, Norman.

Bearden, S. 1976. Lithic analysis. In Gallagher and Bearden.

Bearden, S. 1977. Lithic analysis. In Cheek.

Bearden, S. n.d. A reanalyses of AT-90, Atoka County, Oklahoma. In preparation.

Bell, R. E. 1958. Guide to the Identification of certain American Indian projectile points. Oklahoma Anthropological Society Special Bulletin, No. 1, Oklahoma City.

Bell, R. 1960. Guide to the identification of certain American Indian projectile points. Oklahoma Anthropological Society, Special Bulletin, No. 2. Oklahoma City.

Bobalik, S. J. 1978. Archaeological investigations at the Sallee Creek Site. Pushmataha County, OK. Oklahoma Archaeological Survey Studies in Oklahoma's Past, No. 3, Norman.

Bruner, W. E. 1931. The vegetation of Oklahoma. Ecological Monographs, 1(2):99-188, Norman.

Burton, S. S. and W. Neal. 1970. The Dickson-Haraway Site. Oklahoma River Basin Survey, Archaeological Site Report, No. 20, Norman.

Cahen, D., L. H. Keeley and F. L. Van Noten. 1979. Stone tools, tool kits, and human behavior in prehistory. Current Anthropology, 20(4): 661-684.

Cheek, A. and D. D. Wilcox. 1974. An Assessment of the Cultural Historical Resources of Candy Creek Reservoir, Osage County, Oklahoma. U.S. Army Corps of Engineers, Tulsa District.

Cheek, C. 1977. A cultural assessment of the archeological resources in the Ft. Gibson Lake area, eastern Oklahoma. Archeological Research Associates Research Report, No. 15, Tulsa.

Cheek, C. D., A. L. Cheek, S. Hackenberger, and K. Leehan. 1977. Settlement patterns and contract archaeology: an Oklahoma example. In Conservation Archaeology: A Guide to Cultural Resource Management, ed. by M. Schiffer and G. Gummerman. Academic Press, Inc., pp. 379-389.

Crabtree, D. E. and E. L. Davis. 1968. Experimental manufacture of wooden implements with tools of flaked stone. Science 159:426-28.

Curtis, N. M. and W. E. Ham. 1972. Geomorphic provinces of Oklahoma In Geology and earth resources of Oklahoma: an atlas of maps and cross sections. Oklahoma Geological Survey Educational Publication, No. 1, Norman.

Duck, L. G. and J. B. Fletcher. 1943. A game type map of Oklahoma. Oklahoma Game and Fish Department, Oklahoma City.

Duck, L. G. and J. B. Fletcher. 1945. A survey of the game and fur bearing animals of Oklahoma. Pittman-Robertson Series, No. 11, Oklahoma City.

Farley, J. and J. Keyser. 1979. Little Caney River prehistory: 1977 field season. Laboratory of Archaeology Contributions in Archaeology, No. 5, University of Tulsa, Tulsa.

Gallagher, J. G. and S. E. Bearden. 1976. The Hopewell School Site: a late Archaic campsite in the central Brazos River Valley. Southern Methodist University Institute for the Study of Earth and Man, No. 19, Dallas.

Galm, J. and P. Flynn. 1978. The cultural sequences at the Scott and Wann sites, and prehistory of the Wister Valley. Archaeological Research and Management Center Research Series, No. 3, University of Oklahoma, Norman.

Gettys, M., R. Layle, and S. Bobalik. 1976. Birch Creek and Skiatook reservoirs: preliminary report upon archaeological investigations in 1974. Oklahoma River Basin Survey Archaeological Site Report, No. 31, Norman.

Hall, S. A. 1977a. Geological and paleoenvironmental studies. In Henry 1977b, pp. 11-31.

Hall, S. A. 1977b. Geology and palynology of archaeological sites and associated sediments. In Henry 1977a, pp. 13-31.

Hall, S. A. 1978. Holocene geology and paleoenvironmental history of the Hominy Creek Valley. In Henry 1978, pp. 12-42.

Henry, D. O. (Assembler) 1977a. The prehistory of the Little Caney River: 1976 field season. Laboratory of Archaeology, Contributions in Archaeology. University of Tulsa, Tulsa.

Henry, D. O. (Assembler) 1977b. The prehistory and paleoenvironment of Birch Creek Valley. Laboratory of Archaeology, Contributions in Archaeology. University of Tulsa, Tulsa.

Henry, D. O. (Assembler) 1978. The prehistory and paleoenvironment of Hominy Creek Valley. Laboratory of Archaeology, Contributions in Archaeology, No. 4, University of Tulsa, Tulsa.

Henry, D. O., C. V. Haynes, and B. Bradley. 1976. Quantitative variations in flaked stone debitage. Plains Anthropologist, 21:57-61.

Hester, T. R., D. Giebow, and A. Dalbe. 1973. A functional analysis of 'Clear Fork' artifacts from the Rio Grande Plain, Texas. American Antiquity, 38(1):90-96.

Hester, T. R. and R. F. Heizer. 1973. Arrow points or knives? Comment on the proposed function of "Stockton Points." American Antiquity, 38(2):220-221.

Hofman, J. 1975. The Easton Site. Oklahoma Highway Archaeological Survey, Papers in Highway Archaeology, No. I, Oklahoma City.

House, J. H. and J. W. Smith. 1975. Experiments in replication of fire-cracked rock. In Schiffer and House, 1975, pp. 81-92.

Hunt, C. B. 1967. Physiography of the United States. N. H. Freeman, San Francisco.

Huckaby, K. 1979. Edge modification of chert artifacts: a microscopic analysis. MA thesis, Southern Methodist University Department of Anthropology, Dallas.

Keeley, L. 1974. Technique and methodology in microwear studies: a critical view. World Archaeology, 5:323-36.

Keller, C. M. 1966. The development of edge damage patterns on stone tools. Man 1:501-11.

Lee, R. 1965. Subsistence ecology of the ! Kung Bushman. Ph.D. dissertation, Dept. of Anthropology, University of California, Berkeley.

Lee, R. and I. Devore, eds. 1976. Kalahari Hunter/Gatherers. Harvard University Press, Cambridge.

Leehan, K., K. Duncan, S. Hackenberger, and B. Stewart. 1977. Archeological investigations at Candy Lake, Osage County, Oklahoma. Archeological Research Associates Research Report No. 9, Tulsa.

Lynott, M. J. 1975. Explanations of microwear patterns on gravers. Plains Anthropologist 29(62):121-28.

Lynott, M. J. 1978. Bear Creek Shelter. Archaeology Research Program Research Report, 115. Southern Methodist University, Dallas.

Nance, J. P. 1971. Functional interpretations from microscopic analysis. American Antiquity 39(3), 361-366.

Noel-Hume, I. 1968. Historical Archaeology. Alfred A. Knopf, New York.

Odell, G. H. 1975. Micro-wear in perspective: a sympathetic response to Lawrence H. Keeley. World Archeology 7(2):226-40.

Oklahoma Water Resources Board. 1971 Appraisal of the water and related land resources of Oklahoma, region nine. Oklahoma Water Resources Board Publications, 36.

Ott, L. 1977. An Introduction to Statistical Methods and Data Analysis. Luxbury Press, N. Scituate, Mass.

Perino, G. 1968. Guide to the identification of certain American Indian projectile points. Oklahoma Anthropological Society Special Bulletin, No. 3, Oklahoma City.

Salisbury, N. 1980. Soil-geomorphic relationships with archeological sites in the Keystone Reservoir area, Oklahoma. In A cultural assessment of the archeological resources in the Keystone Lake project area, North-Central Oklahoma, by Bruce M. Moore. Archeological Research Associates Research Report, No. 23, Tulsa.

Schiffer, M. B. 1975. An alternative to Morse's Dalton settlement pattern hypothesis. Plains Anthropologist 20:253-266.

Schiffer, M. J. and J. H. House. 1975. The Cache River archeological project, an experiment in contract archeology. Arkansas Archeological Survey Research Series, No. 8, Fayetteville.

Schneider, F. 1967. Eight archaeological sites in Webber's Falls Lock and Dam area, Oklahoma. Oklahoma River Basin Survey Project Archaeological Site Report, No. 7, Norman.

Shafer, H. J. and V. M. Bryant. 1977. Archeological and botanical studies at Hinds Cave, Val Verde County, Texas. Anthropology Laboratory, Special Series #1. Texas A & M, College Station.

Shafer, H. J. and R. G. Holloway. 1977. Organic residue analysis and stone tool function from Hinds Cave. In Shafer and Bryant, 1977, pp. 103-128.

Sheets, P. D. 1974. Edge abrasion during biface manufacture. American Antiquity 38:215-18.

Silverbauer, G. 1965. Report to the government of Bechuana Land on the Bushman survey. Bechuana Land Government Publication.

Skinner, A. S. and J. Gallagher. 1974. The evaluation of archaeological resources at Lake Whitney, Texas. Southern Methodist University Contributions in Anthropology, No. 14, Dallas.

Thomas, D. H. 1976. Figuring Anthropology. Holt, Rinehart, and Winston, New York.

Thornbury, W. D. 1965. Regional Geomorphology of the United States. Wiley, New York.

Tringham, R., G. Cooper, G. Odel, B. Voitek, and A. Whitman. 1974. Experimentation in the formation of edge damage: a new approach to lithic analysis. Journal of Field Archaeology 1:171-196.

Turner, D. H. 1978. Dialect in tradition: myth and social structure in two hunter-gatherer societies. Royal Anthropological Institute of Great Britain and Ireland, Occasional Paper, 36.

Van Noten, F. L., D. Cahen, and L. Keeley. 1980. A paleolithic campsite in Belgium. Scientific American 242(4):48-55.

Vehik, S. C., K. J. Buehler, and A. J. Wormser. 1979. A cultural resource survey of the Salt Creek Valley, Osage County, Oklahoma. Oklahoma Archeological Survey, Archeological Resource Survey Report, No. 9.

Yellen, J. E. 1977. Archaeological Approaches to the Present: Models for Reconstructing the Past. Academic Press, New York.

Young, W. 1978. Kaw Reservoir: the northern section, part II. Oklahoma River Basin Survey Archaeological Site Report, No. 33, Norman.

APPENDIXES

APPENDIX 1

CHARACTERISTICS OF MAJOR SOIL TYPES AND COMPLEXES

IN THE CANDY CREEK AREA

Description of Common Soil Types in the Candy Lake Impoundment Area

Wynona Silty Clay Loam

These are deep, somewhat poorly drained, slowly permeable soils on floodplains. The surface layer is black to very dark grayish brown silty clay loam.

Depth (in.)	Texture (USDA)	Permeability (in/hr)	Available Water Capacity (in/in)	Soil Reaction (pH)
0-34	Sicl	0.2-0.6	0.18-0.22	5.1-6.5
34-63	Sicl, Sic	0.06-0.2	0.14-0.20	5.1-6.0

Flooding -	Frequency	Duration	Months
	Occasional	v. brief	Jan.-Jul.

Cleora Fine Sandy Loam, Undulating

These are deep, well drained, moderately rapidly permeable soils of floodplains. The surface layer is dark brown fine sandy loam. The subsoil and underlying material are brown and dark yellowish brown fine sandy loam. Slopes are 0 to 3 percent.

Depth (in.)	Texture (USDA)	Permeability (in/hr)	Available Water Capacity (in/in)	Soil Reaction (pH)
0-16	FSL	2.0-6.0	0.11-0.20	5.6-7.3
16-36	L, FSL	2.0-6.0	0.11-0.20	
36-72	L, FSL, LFS	2.0-6.0	0.07-0.20	5.6-7.3

Flooding -	Frequency	Duration	Months
	Common	v. brief	Jan.-Jul.

Verdigris Silt Loam

These are deep, moderately permeable soils on floodplains. The surface is very dark grayish brown silt loam. The subsoil is very dark grayish brown mottled silty clay loam.

Depth (in.)	Texture (USDA)	Permeability (in/hr)	Available Water Capacity (in/in)	Soil Reaction (pH)
0-21	Sil	0.6-2.0	0.22-0.24	5.6-7.3
21-71	Sil, Sicl	0.6-2.0	0.17-0.22	5.6-7.3

Verdigris Silt Loam (Cont.)

Flooding - Frequency	Duration	Months
Rare common	v. brief	Dec.-Jun.

Barnsdall Very Fine Sandy Loam

These are deep, well drained, moderately permeable soils on floodplains. The surface and subsurface layers are brown very fine sandy loam. The subsoil is reddish brown clay loam. The underlying material is brown fine sandy loam. Slopes are 0 to 1 percent.

Depth (in.)	Texture (USDA)	Permeability (in/hr)	Available Water Capacity (in/in)	Soil Reaction (pH)
0-11	VFSL	0.6-2.0	0.13-0.20	5.6-7.3
11-58	CL, Sicl	0.6-2.0	0.15-0.20	5.1-7.3
58-72	FSL, L, CL	0.6-2.0	0.11-0.17	5.1-6.0

Flooding - Frequency	Duration	Months
Rare		

Mason Silt Loam, 0 to 1 Percent Slopes

These are deep, well drained, moderately slowly permeable soils on floodplains. The surface layer is very dark grayish brown silt loam. The subsoil is brown and dark brown silty clay loam in upper part and a brown mottled silty clay loam in the lower part.

Depth (in.)	Texture (USDA)	Permeability (in/hr)	Available Water Capacity (in/in)	Soil Reaction (pH)
0-13	Sil	0.6-2.0	0.16-0.20	5.1-7.3
13-96	Sicl, Cl, Sil	0.2-0.6	0.16-0.20	4.5-7.8

Flooding - Frequency	Duration	Months
Rare	v. brief	Dec.-Apr.

Coweta-Bates Complex, 1 to 8 Percent Slopes

This is a complex of Coweta and Bates soils on uplands. The Coweta soils are shallow, well drained to somewhat excessively drained and moderately permeable. The surface layer is very dark brown loam. The subsoil is dark brown loam that is underlain by sandstone at about 16 inches. Bates soils are moderately deep, well drained and moderately permeable. The surface layer is very dark grayish brown loam. The subsoil is brownish sandy clay loam that is underlain by soft sandstone at about 22 inches.

Coweta-Batex Complex 1 to 8 Percent Slopes (Cont.)

	Depth (in.)	Texture (USDA)	Permeability (in/hr)	Available Water Capacity (in/in)	Soil Reaction (pH)
C:	0-9	L	2.0-6.0	.09-.16	5.1-6.5
	9-16	FSL, L, CL	0.6-2.0	.09-.18	5.1-6.5
	16-20	WB			
B:	0-12	L	0.6-2.0	.20-.22	5.1-6.5
	12-22	L, CL, SCL	0.6-2.0	.15-.19	5.1-6.5
	22-24	WB			

Flooding -	Frequency	Duration	Months
C:	None		
B:	None		

Steedman-Coweta Complex, 3 to 15 Percent Slopes

This is complex of Steedman and Coweta soils on uplands. The Steedman soils are moderately deep, moderately well drained, and slowly permeable. The surface layer is very dark grayish brown stony silt loam. The subsoil is mottled brownish silty clay. The underlying material is shale at about 28 inches. The Coweta soils are shallow, well drained to somewhat excessively drained, and moderately permeable. The surface layer is very dark grayish brown stony loam. The subsoil is dark grayish brown gravelly loam. The underlying material is sandstone at about 12 inches.

	Depth (in.)				
S:	0-8	STX-SIL	0.6-2.0	.12-.22	5.1-6.5
	8-28	SICL, SIC	.06-.20	.12-.18	5.6-8.4
	28-60	WB			
C:	0-6	L, FSL, STX-L, STX-FSL	2.0-6.0	.09-.16	5.1-6.5
	6-12	FSL, L, CL	0.6-2-0	.09-.18	5.1-6.5
	12-16	WB			

Flooding -	Frequency	Duration	Months
S:	None		
C:	None		

Dennis-Carytown Complex, 1 to 5 Percent Slopes

This is a complex of Dennis and Carytown soils on uplands. The Dennis soils are deep, moderately well drained, and slowly permeable. The surface layer is very dark grayish brown silt loam. The upper subsoil is mottled brownish silty clay loam. The lower subsoil is coarsely mottled silty clay. Carytown soils are deep, poorly drained, and very slowly permeable. The surface layer is a thin dark grayish brown silt loam. The subsoil is coarsely mottled silty clay, high in sodium.

Depth (in.)	Texture (USDA)	Permeability (in/hr)	Available Water Capacity (in/in)	Soil Reaction (pH)
D: 0-11	SIL	0.6-2.0	.15-.20	5.1-6.0
11-16	SICL, CL	0.2-.60	.15-.20	4.5-6.0
16-75	C, SIC, SICL	.06-.20	.15-.20	5.8-8.4
C: 0-9	SIL	0.6-2.0	.15-.20	5.1-7.3
9-72	SIC, C	.06	.08-.11	5.6-8.4

Flooding -	Frequency	Duration	Months
D:	None		
C:	None		

APPENDIX 2

PROFILE DESCRIPTIONS

Soil Profile #1

0-26 cm	Brown (10YR 5/3 D) silt loam possessing medium, coarse crumb structure; dry consistence slightly hard, moist friable; wet sticky, plastic. No HCL reaction; clear wavy boundary.
26-43 cm	Brown (7.5YR 5/4 D) ped interiors, pale brown (10YR 6/3 D) ped exteriors, silt loam possessing strong, medium-coarse subangular blocky structure. Dry consistence slightly hard, moist friable; wet slightly sticky, slightly plastic-plastic. No HCL reaction; clear wavy boundary.
43-218 cm	Dark reddish brown (5YR 3/4 M) to reddish brown (5YR 4/4 D) ped interiors, dark reddish brown (5YR 3/2 M), 5YR 3/2.5 D) films developed on silty clay loam possessing strong, medium prismatic structure breaking to fine-medium angular blocky structure. Dry consistence very hard, moist firm; yet very sticky, very plastic. No HCL reaction; many moderately thick-thick clay films on ped faces; gradual wavy boundary.
218-316 cm	Brown (10YR 5/3 M) ped interiors with dark reddish grey-reddish brown (5YR 4/2.5 M) films on ped exteriors. Yellowish brown oxidation stains on some ped exteriors and around rootlet channels. Silty clay loam possessing strong, coarse angular blocky structure; dry consistence very hard-extremely hard, moist very firm; wet very sticky, very plastic. Common, moderately thick clay films on ped faces. Diffuse, smooth boundary.
316-550+cm	Brown (10YR 4.5/3 M) ped interiors with dark greyish brown (10YR 4/2 M) films. Common fine-medium yellowish brown (10YR5/8 M) to strong brown (7.5YR 5/6 M) oxidation mottles, Silty clay loam possessing strong, coarse angular blocky structure; dry consistence extremely hard, moist extremely firm; wet very sticky, very plastic. Strong, thick clay films on ped faces. No HCL reaction, lower boundary not observed.

Soil Profile #2

0-30 cm	Brown (10YR 5/3 D) silt loam possessing medium, coarse crumb structure; dry consistence slightly hard, moist friable; wet sticky, plastic. No HCL reaction; clear, wavy boundary.
30-120 cm	Strong brown (7.5YR 5/6 M, 7.5YR 5.5/5D) silt loam-silty clay loam possessing strong, fine-medium angular blocky structure with dark brown (7.5YR 3/2 M) to dark reddish brown (5YR 4/2 D) common moderately thick clay films on ped faces. Below 60 cm ped faces and clay films commonly

Soil Profile #2 (Cont.)

	coated with very dark grey (7.5YR 3/0 D) MnO_2 (?) film. MnO_2 films decrease at 110 cm, almost absent at 120 cm. Color almost imperceptibly lightens with depth so that at 90 cm ped interiors are light brown to reddish yellow (7.5YR 6.5 D) and at 119 cm the color is brownish yellow (10YR 6/6 D). Dry consistence is extremely hard, moist very firm; wet sticky, plastic. No HCL reaction; boundary gradual, smooth.
120-250 cm	Yellowish brown (10YR 5/4 D) to brown-dark brown (10YR 4/3 M) silty clay loam possessing strong, medium prismatic structure breaking to fine-medium angular blocky, common moderately thick clay films on ped faces. Dry consistence extremely hard, moist firm, wet sticky-very sticky, plastic. Common yellowish brown (10YR 5/6 D, 10YR 5/8 M) fine-medium mottles. No HCL reaction; boundary gradual, smooth.
250-350 cm	Light yellowish brown (2.5Y 6/4 D) to yellowish brown (10YR 5/4) silty clay loam possessing strong, medium prismatic structure breaking to fine-medium angular blocky, common moderately thick-thick clay films on ped faces. Dry consistence extremely hard, moist firm, wet sticky-very sticky, plastic. Common-many yellowish brown (10YR 5/8 M, D) medium-coarse oxidation mottles. No HCL reaction; boundary diffuse, smooth.
350-500 cm	Brown (10YR 5/3 M) silty clay loam possessing strong, fine-medium angular blocky structure. Common dark greyish brown (10YR 4/2 M) moderately thick-thick clay films on ped faces. Dry consistence extremely hard, moist firm, wet sticky-very sticky, plastic. Common-many dark brown-brown (7.5YR 4/4) oxidation mottles. No HCL reaction; boundary diffuse smooth.
500-1020+cm	Dark greyish brown (10YR 4/2 M) to light brownish grey (2.5Y 6/2 D) silt loam possessing strong medium-fine angular blocky structure. Clay films common, moderately thick on ped faces. Dry consistence extremely hard, moist firm; wet sticky, plastic. Common yellowish brown (10YR 5/6 M) and brownish yellow medium oxidation mottles. No HCL reaction, lower boundary below present stream level.

Soil Profile #3

0-35 cm	Dark greyish brown (10YR 4/2 D) to dark brown (7.5YR 3/2 M) silt loam possessing moderate-strong coarse subangular blocky structure. Dry consistence very hard, moist very friable; wet sticky, plastic. No HCL reaction; boundary clear, wavy.

Soil Profile #3 (Cont.)

35-123 cm	Brown-strong brown (7.5YR 5/5 D) and brown-dark brown (7.5YR 4/4) silt loam possessing strong prismatic structure breaking to medium coarse angular blocky. Common-many reddish brown (5YR 4/3 D) to dark reddish brown (5YR 3/2 M) moderately thick-thick clay films on ped faces. Dry consistence extremely hard, moist very firm; wet sticky, plastic. No HCL reaction; boundary diffuse, smooth.
123-266 cm	Brown (7.5YR 4.5/4 D) to brown-dark brown (7.5YR 4/4M) silt loam-silty clay loam with strong, medium prismatic structure breaking to medium-coarse angular blocky. Clay films are reddish brown (5YR 4/3 D) to dark reddish brown (5YR 3/2 M), common, moderately thick and are located on ped faces. No HCL reaction; lower boundary gradual smooth.
226-341 cm	Light yellowish brown (10YR 6/4) to brown-dark brown (7.5YR 4/4 M) fine loam-sandy loam of alluvial origin. Structure is massive, breaking to coarse weak subangular blocky. Dry consistence hard, moist friable, wet slightly sticky, slightly plastic. No HCL reaction; boundary gradual, smooth.
341-392 cm	Brownish yellow (10YR 6/6 D) to yellowish brown (7.5YR 5.5/5 M) loam possessing strong, medium angular blocky structure. Few, thin brown-dark brown (7.5YR 4/4 D) to brown (7.5YR 5/2M) clay films on ped faces. Dry consistence hard, moist firm; wet sticky, plastic. No HCL reaction; boundary abrupt, smooth, inclined to center of former channel.
392-422 cm	Very pale brown (10YR 7/4 D) to light yellowish brown-brownish yellow (10YR 6/5 M) fine sandy loam of alluvial origin. Structure massive; dry consistence slightly hard, moist friable, wet slightly sticky, slightly plastic. No HCL reaction; boundary clear, wavy.
422-500 cm	Pale brown (10YR 6/3 D) to brown (10YR 5/3 M) fine sandy loam with approximately 40% fine-large yellowish brown (10YR 5/8 D) mottles. Structure is massive; dry consistence hard, moist firm; wet slightly sticky, slightly plastic. Weak HCL reaction begins at 422. By 440 reaction is strong and small white (10YR 8/1 D) $CaCO_3$ nodules and pore fillings are present. Boundary abrupt, smooth.
500-514 cm	Light grey (10YR 7/2 M) thin-bedded fine alluvial sand with brownish yellow (10YR 6/6 M) oxidation.
514-539 cm	Brown (10YR 5/3 M) loamy fine sand. Boundary abrupt, irregular.

Soil Profile #3 (Cont.)

539-546 cm	Pale brown (10YR 6/3) cross-bedded fine sand. Boundary abrupt, smooth.
546-584 cm	Alternating pale brown (10YR 6/3 M) and greyish brown (10YR 5/2 M) fine sands. Greyish brown predominates toward bottom of horizon. Greyish brown (10YR 5/2 M) silt loam lenses locally present at lower boundary. Boundary abrupt, wavy.
584-608 cm	Light grey (2.5Y 7/2 M) thinly- and crossbedded fine and coarse sands with occasional small pebbles and granules. Coarser beds are oxidized to strong brown (7.5YR 5/6 M).
608-620 cm	Alterating pale brown (10YR 6/3 M) and greyish brown (10YR 5/2 M) sands and sandy loam. Lower boundary is abrupt, irregular and marks bottom of channel at this point. Note: Maximum channel depth is approximately 2.5 m deeper than at profile.
620-920+ cm	Dark greyish brown (10YR 4/2 M) silt loam possessing strong, medium-fine angular blocky structure. Common moderately thick clay films present on ped faces. Moist consistence firm; wet sticky, plastic. Common medium and large yellowish brown (10YR 5/6 M) oxidation mottles. No HCL reaction; lower boundary covered.

Os-155 - Excavation Area 1

0-9 (plow zone)	Very greyish brown (10YR 3/2 M) to dark greyish brown (10YR 4/2 D) silt loam with moderate fine-medium crumb structure. Dry consistence hard, moist friable-firm; wet slightly sticky, slightly plastic. Boundary clear, smooth.
9-31	Dark greyish brown (10YR 4/2.5 D) to very dark greyish brown (10YR 3/1.5 M) silt loam with moderate, medium-coarse crumb-fine subangular blocky structure. Dry consistence hard, moist friable-firm, wet slightly sticky, slightly plastic. Boundary gradual, smooth.
31-44	Brown-dark brown (10YR 4/3 D) to dark brown (10YR 3/3 M) silt loam possessing moderate, medium-coarse subangular blocky structure. Dry consistence hard, moist firm, wet sticky, plastic. Considerable evidence of earthworm activity. Boundary clear, wavy.
44-59	Yellowish brown (10YR 5/4 D) to dark brown (10YR 3.5/3.5 M) silt loam with moderate-strong, coarse subangular blocky structure. Few, thin, dark greyish brown (10YR 4/2 D) to very dark greyish brown (10YR 3/2 D) clay skins

Os-155 - Excavation Area 1 (Cont.)

	are present on ped faces. Dry consistence very hard, moist firm; wet sticky, plastic. Silt and/or fine sand flour also commonly present on ped faces and coating clay skins. Boundary clear, smooth.
59-75+	Yellowish brown (10YR 5/4 D) to dark yellowish brown (10YR 4/4 M) silt loam possessing strong, medium-coarse prismatic structure breaking to angular blocky. Many thin-moderately thick dark reddish grey (5YR 4/2 D) to dark brown clay skins are present on ped faces. Silt flour, occasionally thick, is present as a very pale brown (10YR 7/3 D) coating on some ped surfaces and clay films. Dry consistence very hard, moist firm; wet sticky, plastic. Lower boundary unobserved.

Os-155 Excavation Area 2

0-16 (plow zone)	Dark brown (10YR 3/3 D) to very dark greyish brown (10YR 3/1.5 M) silt loam with weak-moderate, fine-medium crumb-subangular blocky structure. Dry consistence hard, moist friable; wet sticky, plastic. Boundary clear, wavy.
16-32	Very dark greyish brown (10YR 3/2 D) to very dark brown (10YR 2.5/2 M) silt loam possessing weak-moderate, medium subangular blocky structure. Dry consistence hard-very hard, moist friable; wet sticky, plastic. Boundary gradual, smooth.
32-51	Dark brown (10YR 3/3 D, 10YR 3.5/3.5 M) silt loam with moderate, medium prismatic structure. Common, moderately thick very dark greyish brown clay films are present on ped faces. Dry consistence very hard, moist very firm; wet slightly sticky-sticky, plastic. Boundary gradual-diffuse, smooth.
51-60+	Dark yellowish brown (10YR 4/4 D, M) silt loam possessing moderate, medium prismatic structure. Common moderately thick clay skins present on ped faces are very dark greyish brown (10YR 3/2 D). Dry consistence very hard, moist very firm; wet sticky, plastic. Boundary unobserved.

Os-155 - Excavation Area 3

0-14 (plow zone)	Dark greyish brown (10YR 4/2 D) to very dark greyish brown (10YR 3/2 M) silt loam with weak-moderate, fine-medium crumb structure. Dry consistence hard, moist firm; wet slightly sticky, slightly plastic. Boundary gradual, smooth.

Os-155 - Excavation Area 3 (Cont.)

14-36	Dark grey-dark greyish brown (10YR 4/1.5 D) to very dark grey (10YR 3/1.5) silt loam possessing moderate, medium-coarse crumb-subangular blocky structure. Dry consistence slightly hard-hard, moist friable-firm; wet sticky, plastic. Boundary gradual, smooth.
36-54	Brown (10YR 5/3 D) to dark yellowish brown (10YR 4/3.5 M) silt loam with moderate, medium prismatic structure breaking to angular blocky. Dry consistence hard-very hard, moist firm; wet sticky, plastic. Boundary gradual, smooth.
54-65	Greyish brown (10YR 5/2 D) to dark greyish brown (10YR 3.5/2.5 M) silt loam with moderate-strong prismatic structure breaking to angular blocky. Dry consistence very hard, moist very firm; wet sticky, plastic. Boundary clear, smooth-wavy.
65-85	Very dark brown (10YR 2.5/3.5 D) to dark brown (7.5YR 3/2 M) silty clay loam with strong medium prismatic structure breaking to angular blocky. Dark reddish brown (5YR 3/2.5 D) clay skins are common and form thin to moderately thick coatings on ped faces. Very pale brown (10YR 7/3) silt flour coats most ped faces. Dry consistence extremely hard, moist extremely firm; wet very sticky, plastic. Boundary unobserved.

APPENDIX 3

APPENDIX 3

ARTIFACT AND MATERIAL CATALOGUE

Appendix Key

Material Type

1. Kay County
2. Kay Gravel
3. Keokuk
4. Worland
5. Tahlequah
6. Woodford
7. Neva
8. Other
9. Kay County (?)

Artifact Type

1. Primary Flakes
2. Secondary Flakes
3. Tertiary Flakes
4. Debris
5. Heat Spalls
6. Soft Scraping
7. Hand Scraping
8. Soft Cutting
9. Hand Cutting
10. Graver

Symbols

projectile point	- *	graver	- &
biface	- #	core	- %
uniface	- ¢	utilized flake	- !

Tools are recorded by edge wear.

Os-149

Surface East of Fence
North 1/3 of Site
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	6									6
5										
6										
7										
8										
9										
10										
Total	8									8

Surface
North 1/3 of Site
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2							1			1
3			1		1					2
4	5		1					1		7
Total	5		2		1		1	1		10

Surface
Central 1/3 of Site
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	[PC of Jasper 2nd] Total
1										(1)
2									1	
3	2									2
4	10		2		1			2		15
5										
6	Also 2 Keokuk Pebbles _ Kay Co. (No Cortex)									(3)
7	(2)									
8										
9										
10										
Total	13		4		1			2	1	21

Surface
West of Fence Line
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2									2
3	11	2	2			1	2	1		19
4	28				1		5	5		39
5	1					1				2
6										
7	1									1
8										
9	1									1
10										
Total	44	2	2		1	2	7	6		64

Surface Item 04

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2					2			1		3
3										
4	4		4	1				2		11
5										
6										
7								1		1
8	1									1
9										
10										
Total			4	1	2			4		16

Surface Tools
General
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
Biface			1						1	2
Scraper	2						1			3
Utilized Flake	1		1							2
Core	1									1
Total	4		2				1		1	8

Surface S1/3 of Site
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	4									4
4	5		4		2	1	1			13
5	1									1
6										
7										
8										
9										
10										
Total	11		4		2	1	1			19

Surface Tools
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
			--South 1/3--							
Biface			3							3
Biface Chipper			1				1			2
			--North 1/3--							
Biface			1							1
Total			5				1			6

ER 01, Level A=0-10

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	2							4		6
5										
6										
7										
8										
9										
10										
Total	2							4		6

ER 01, Level E, 1/4 in. screen
(1/16 in. screen NW quadrant)
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1 (3)									4
5										
6										
7										
8										
9										
10										
Total	4									4

ER 01, Levels B,C=0; D
1/4 in. Screen
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER 01, Level F, 1/4 in. screen
(1/16 in. screen NW quadrant)
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	4 (2)									6
4	3 (4)							(1)		8
5										
6										
7										
8										
9										
10										
Total	13							1		14

ER 01, Level G, 1/4 in. screen
(1/16 in. screen NW quadrant)
Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	(1) 3									4
5										
6										
7										
8										
9										
10										
Total	4									4

ER 02, Level A=0-8 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	3									3
5										
6										
7										
8										
9										
10										
Total	3									3

ER 01, Level H

Raw Material Type

70-80

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4										
5										
6										
7										
8										
9										
10										
Total	1									1

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 02, Levels B-D, 10-38 cms.=0; E
(1/16 in. screen NW quadrant)
Raw Material Type

1/16

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4								(2)		2
5										
6										
7										
8										
9										
10										
Total								2		2

ER 02, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER 02, Level F
(1/16 in. screen NW quadrant)
Raw Material Type

1/16

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	(1)									1
3			(1)	(1)						2
4										
5										
6										
7										
8										
9										
10										
Total	1		1	1						3

ER 02 , Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	2							3		5
5										
6										
7										
8										
9										
10										
Total	2							3		5

ER 02, Level I

Raw Material Type

80-90

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	2									2
5										
6										
7										
8										
9										
10										
Total	2									2

ER 02, Level K 100-110 cm=0

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 02, Level J

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	2									2
5										
6										
7										
8										
9										
10										
Total	2									2

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 03, Level A=0-15 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4			1							1
5										
6										
7										
8										
9										
10										
Total			1							1

ER 03, Level B =15-25 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3			1							1
4	1									1
5										
6										
7										
8										
9										
10										
Total	1	1								2

ER 03, Level C=25-35 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	1									1
5										
6										
7										
8										
9										
10										
Total	2									2

ER 03, Level D=0, E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	2									2
5										
6										
7										
8										
9										
10										
Total	2									2

ER 03, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3								1		1
4										
5										
6										
7										
8										
9										
10										
Total								1		1

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

34 Os-149

HISTORIC ARTIFACTS

Surface

General

Glass:	6 pcs. magnesium blue
	2 pcs. brown
	1 pc. milk glass
	8 pcs. "Pepsi" bottle fragments
Ceramics:	1 stoneware
	2 decalcomania ironstone
	4 blue transfer, 2 scalloped edges
	26 plain ironstone
	--3 scalloped rims
	--1 plain rim
	--1 makers mark
Metal:	1 iron rivet
	2 pcs. iron
	4 bolts
Misc.:	2 pcs. turtle shell
	1 bone fragment

South 1/3

Glass:	1 pcs. magnesium blue
Ceramics:	2 pcs. stoneware, 1 salt glazed
	2 pcs. ironstone
Metal:	1 threaded ring

East of Fence

Ceramics:	1 pcs. ironstone

North 1/3

Glass:	4 pcs. clean

ER1		None
ER2	B	1 wire nail
		1 large bolt
	G	wire/cut nails
	I	1 wire nail

34 Os-149 (Cont.)

ER3	A	2 wire nails
		2 pcs. glass
	B	4 wire nails

Os-153

ER , Level (Surface)

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6			1*							1
7								1#		1
8	1¢									1
9										
10										
Total	1		1					1		3

Item 4 lithic scatter/historic sherds

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 01, Level A

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4			1							1
5										
6										
7										
8										
9										
10										
Total			1							1

ER 01, Levels B-D=0; E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER 01, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

Piece brown mottled glass
1 wire nail

ER 01, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4					1					1
5										
6										
7										
8										
9										
10										
Total					1					1

ER 01, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1				1					2
5										
6										
7										
8										
9										
10										
Total	1				1					2

ER 01, Level J

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER 01, Level I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4					2			4		6
5										
6										
7										
8										
9										
10										
Total					2			4		6

ER 01, Levels K,L=0; M

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

2 Kay Co. Heat Spalls

AD-A103 436 ARCHEOLOGICAL RESEARCH ASSOCIATES TULSA OK F/G 5/6
A REASSESSMENT OF CERTAIN ARCHEOLOGICAL SITES IN THE CANDY LAKE--ETC(U)
1980 J SAUNDERS, C D CHEEK, F NIALS DACW56-79-C-0040
UNCLASSIFIED RR-22 NL

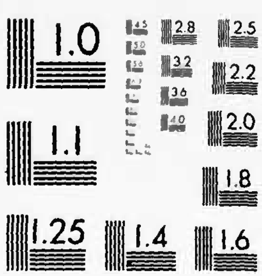
3 OF 3
AD
A103436

END
DATE
FILMED
10-81
DTIC

LASSIF.

3 OF 3

AD A103436



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

ER 01, Level N

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER 02, Level A

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	4							11		15
5										
6										
7										
8										
9										
10										
Total	4							11		15

ER 01, Levels O, P, Q,=0

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 02, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4								10		10
5										
6										
7	1									1
8										
9										
10										
Total	1							10		11

ER 02, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	5		2							7
5										
6										
7										
8										
9	1									1
10	1									1
Total	9		2							11

ER 02, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1	1									1
2										
3	1									1
4	4									4
5										
6										
7										
8										
9										
10										
Total	6									6

1 grit tempered ceramic sherd

Os-155

ER 01, Level A=0-10 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1				1					2
4	1		4							5
5	1									1
6										
7										
8										
9										
10										
Total	3		4		1					8

ER 01, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4					1					1
5										
6										
7										
8										
9										
10										
Total	2				1					3

ER 01, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3					2					2
4	2		1						1	4
5										
6										
7										
8										
9										
10										
Total	3		1		2				1	7

ER 01, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	2									2
4	5				1					6
5										
6										
7										
8										
9										
10										
Total	8				1					9

ER 01, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	5									5
4	10									10
5										
6										
7	1									1
8										
9										
10										
Total	16									16

ER 01, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	2									2
4	2									2
5										
6										
7										
8										
9	1%									1
10										
Total	6									6

ER 02, Level A=0; B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4										
5										
6										
7										
8										
9										
10										
Total	1									1

ER 02, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4			1							1
5										
6										
7										
8										
9		1#								1
10										
Total		1	1							2

ER 02, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4				1						1
5										
6										
7										
8										
9										
10										
Total				1						1

ER 02, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	3									3
4	2				1					3
5										
6										
7										
8										
9										
10										
Total	5				1					6

ER 02, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	17							1		18
4	19									19
5										
6										
7										
8	(1#1¢)									2
9										
10										
Total	38							1		39

ER 02, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	5									5
4	4									4
5										
6										
7										
8										
9										
10										
Total	10									10

ER 02, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2									2
3	2									2
4	10									10
5										
6										
7										
8										
9										
10										
Total	14									14

ER 02, Level I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	1						3			4
4	1						3		1	5
5										
6										
7										
8										
9										
10	1									1
Total	4						6		1	11

ER 02, Level J

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4							1			1
5										
6										
7										
8										
9										
10										
Total							1			1

ER 03, Levels A=0-6 cms, 0; B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2			1							1
3										
4	2		1							3
5			1							1
6										
7										
8										
9										
10										
Burin Spall	1									1
Total	3		3							6

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 03, Level C=0; D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3								1		1
4	1									1
5										
6										
7										
8										
9										
10										
Total	2							1		3

ER 03, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	5									5
4	4		1							5
5										
6	1¢									1
7										
8										
9										
10										
Total	10									11

ER 03, Level G

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	7									7
4	6							3		9
5										
6										
7										
8										
9										
10										
Total	14							3		17

ER 03, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	7									7
3	15									15
4	24							1		25
5										
6	(1#)2									3
7	1									1
8										
9	1#									1
10	1									1
Total	52							1		53

ER 04, Level A=0-7 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	2									2
5										
6										
7										
8										
9										
10										
Total	2									2

ER 04, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	4									4
4	9									9
5										
6	1									1
7										
8										
9										
10										
Total	15									15

ER 04, Levels B,C=0; 0

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4										
5										
6										
7										
8										
9										
10										
Total	1									1

ER 04, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	4		1							5
4	21		1					3		25
5										
6										
7										
8										
9	(1¢)1									2
10										
Total	27		2					3		32

ER 04, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	3									3
4	5		1					1		7
5	1									1
6										
7										
8		1*								1
9										
10										
Total	9	1	1					1		12

ER 04, Level I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	4		1							5
4	13									13
5										
6	1									1
7										
8	1									1
9										
10										
Total	19									20

ER 04, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	4								1	5
5										
6										
7										
8										
9										
10										
Total	5								1	6

ER 04, Level J

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER 05, Level A=0-8 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2				1					2	3
3				1					3	4
4	3								3	6
5			1							1
6										
7										
8										
9										
10										
Total	3		1	2					8	14

ER 05, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3				2						2
4										
5										
6										
7										
8										
9										
10										
Total				2						2

ER 05, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2		1								1
3			1			1	1		3	6
4			2	1	1	2	3		3	12
5										
6					1				1	2
7										
8										
9										
10										
Total		1	3	1	2	3	4		7	21

ER 05, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2		1		1					1	3
3				2					2	4
4				1						1
5										
6										
7										
8										
9										
10										
Total		1		4					3	8

ER 05, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	1									1
5										
6										
7										
8										
9										
10										
Total	3									3

ER 06, Level A=0-9 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4				1						1
5										
6										
7										
8										
9										
10										
Total	1			1						2

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 06, Levels B-D=0; E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER 06, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	5							2		7
5								1		1
6										
7										
8										
9										
10										
Total	5							3		8

ER 06, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	1									1
4	4									4
5										
6										
7										
8										
9										
10										
Total	6									6

ER 06, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	4									4
5										
6										
7										
8										
9										
10										
Total	4									4

ER 06, Level I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	2									2

ER 07, Levels A=0, 0-7 cms; B-D=0; E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	5									5
4	2									2
5										
6										
7										
8										
9										
10										
Total	7									7

ER 07, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	4									4
3	18									18
4	30								2	32
5	1									1
6										
7										
8										
9										
10										
Total	53								2	55

ER 07, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2									2
3	9									9
4	8							1		9
5										
6										
7			1							1
8										
9										
10										
Total	19		1					1		21

ER 07, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	4									4
4	7									7
5										
6										
7										
8										
9										
10										
Total	11									11

ER 07 , Level I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	3									3
4	1									1
5										
6										
7										
8										
9										
10										
Total	4									4

ER 08 , Level A=0, 0-7 cms; B=0; C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 08 , Level D=0; E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3										
4	5									5
5										
6										
7										
8		1								1
9										
10										
Total	6	1								7

ER 08, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2									2
3	13									13
4	18									18
5										
6										
7										
8										
9	1									1
10	1									1
Total	35									35

ER08, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	3									3
4	11								2	13
5										
6										
7										
8										
9										
10										
Total	15								2	17

ER08, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	15									15
4	21								4	25
5										
6	1									1
7										
8										
9										
10										
Total	38								4	42

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 09, Levels A=0, 0-10 cms; B-0=0; E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	4									4
5										
6										
7										
8										
9										
10										
Total	6									6

ER 09, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	4									4
4	3							1		4
5										
6	1									1
7										
8										
9	1#									1
10										
Total	10							1		11

ER 09, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2									2
3	18	1								19
4	16									16
5										
6										
7										
8										
9										
10										
Total	36	1								37

ER 09, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3								1		1
4	2		1							3
5										
6										
7	1									1
8										
9										
10										
Total	3		1					1		5

ER 09, Level I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4										
5										
6										
7										
8										
9										
10										
Total	2									2

ER 11, Level A=0-6 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	3		1							4
5										
6	1#									1
7										
8										
9										
10										
Total	4		1							5

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 11, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	1		1				1			3
5										
6										
7										
8										
9		1#								1
10										
Total	2	1	1				1			5

ER 11, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	2			2				1		5
5										
6										
7										
8										
9										
10										
Total	2			2				1		5

ER 11, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2									2
3	7									7
4	9									9
5										
6										
7										
8	1									1
9										
10										
Total	19									19

ER 11, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3									1	1
4	3		1	2						6
5										
6										
7										
8										
9										
10										
Total	3		1	2					1	7

ER 11, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2			1						3
3	11			1						12
4	11									11
5										
6										
7										
8	2									2
9										
10										
Total	26			2						28

ER 11, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	6									6
5										
6										
7										
8										
9										
10										
Total	7									7

ER 13, Level A=0-7 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1							1		2
4										
5										
6										
7										
8										
9										
10										
Total	1							1		2

ER 11, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4										
5										
6										
7										
8										
9										
10										
Total	1									1

ER 13, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3								1		1
4			1							1
5										
6										
7										
8										
9										
10										
Total			1					1		2

ER 13, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	1									1
5										
6										
7										
8										
9										
10										
Total	2									2

ER 13, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	10									10
4	13		1							14
5										
6	(1#)									1
7										
8										
9										
10	1									1
Total	25		1							26

ER 13, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	3									3
5										
6										
7										
8										
9										
10										
Total	3									3

ER 13, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1	2									2
2	2									2
3	11							1		12
4	33		1					3		37
5										
6	(1¢)1									2
7										
8										
9										
10										
Total	50		1					4		55

ER 13, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2									2
3	2									2
4	6									6
5										
6										
7										
8										
9										
10										
Total	10									10

ER 14, Level A, 0-7 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1								1	2
3	1			1					2	4
4									1	1
5										
6				1¢						1
7										
8										
9										
10										
Total	2			2					4	8

ER 14, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1	1		2					1	5
4				1					4	5
5				2						2
6									1	1
7										
8										
9									2#	2
10										
Total	1	1		5					8	15

ER 14, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1	1		1					2	5
3	3			2					5	10
4	1			1		1		2	2	7
5										
6	1			1 (1¢)					1	4
7										
8					1					1
9										
10										
Total	6	1		6	1	1		2	10	27

ER 14, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2									1	1
3									1	1
4										
5										
6										
7										
8										
9										
10										
Total									2	2

ER 14, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2				1						1
3		1		1					1	3
4				3					2	5
5										
6	1¢	1								2
7										
8				1*						1
9										
10		1								1
Total	1	3		6					3	13

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 15, Levels A=0, 0-7 cms; B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1		1							2
5										
6										
7	1¢									1
8										
9	1#									1
10										
Total	3		1							4

ER 15, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	2									2
5										
6										
7										
8										
9										
10										
Total	2									2

ER 15, Level D=0; E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	4									4
4	4									4
5										
6	2									2
7	1¢									1
8										
9										
10										
Total	11									11

ER 15, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3										
4	3									3
5										
6										
7										
8										
9	1%									1
10										
Total	5									5

ER 16, Levels A-C=2; 0

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4		1		1						2
5										
6	1									1
7	1¢									1
8										
9										
10										
Total	2	1		1						4

ER 16, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2		1							3
3	5		1							6
4	10									10
5										
6										
7										
8										
9										
10										
Total	17		2							19

ER 16, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	6		1		1			2		10
5										
6										
7										
8										
9										
10										
Total	6		1		1			2		10

ER 16, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	3									3
3	3									3
4	9									9
5										
6										
7										
8										
9										
10										
Total	15									15

ER 16, Level H=0; I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	2									2
5										
6										
7										
8										
9										
10										
Total	3									3

ER 16, Level J

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER 17, Level A=0-12 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1	1									1
2										
3				1					1	2
4	1		1							2
5										
6										
7										
8		1		1						2
9										
10										
Total	2	1	1	2					1	7

ER 17, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1				1						1
2	1	1		1					2	5
3				2						2
4	1									1
5										
6				1						1
7										
8										
9		1								1
10										
Total	2	2		5					2	11

ER 17, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1									1	1
2		2	1	5				2		10
3	2			10					5	17
4	2			7					4	13
5										
6		1							1	2
7										
8										
9										
10										
Total	4	3	1	22				2	11	43

ER 17, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3				2					1	3
4				3					2	5
5										
6										
7										
8										
9										
10										
Total				5					3	8

ER 17, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1	1									1
2	4									4
3	4		1	4		1			4	14
4	3	1	1	8		1			4	18
5										
6		1								1
7										
8		1#								1
9					1#				1#	2
10										
Total	12	3	2	12	1	2			9	41

ER 17, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2				2						2
3										
4										
5										
6										
7										
8										
9										
10										
Total				2						2

ER 18, Levels A,B,C,D,E=0, 0-40 cms; F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	3									3
4	5									5
5										
6										
7										
8										
9										
10										
Total	9									9

ER 18, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	5									5
4	15									15
5										
6										
7										
8										
9										
10										
Total	20									20

ER 18, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2									2
3	1									1
4	6									6
5										
6	1¢									1
7										
8										
9	1#									1
10										
Total	11									11

ER 18, Level I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	2									2
5										
6										
7										
8										
9										
10										
Total	3									3

ER 19, Levels A=0, 0-7 cms; B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3					1					1
4										
5										
6										
7										
8	1									1
9										
10										
Total	1				1					2

ER 19, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	1									1
5										
6										
7										
8										
9										
10										
Total	3									3

ER 19, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3			2							2
4	2		1							3
5										
6				1						1
7										
8										
9										
10										
Total	2		3	1						6

ER 19, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	2									2
5										
6										
7										
8										
9										
10										
Total	4									4

ER 19, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	2									2
5										
6	1									1
7	(1¢)1									2
8										
9										
10										
Total	6									6

ER 20, Levels A,B,C,D=0,0-40 cms; E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2			1							1
3										
4	1									1
5	1									1
6										
7		1#								1
8										
9										
10										
Total	2									4

ER 19, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	2									2
5										
6										
7										
8										
9										
10										
Total	4									4

ER 20, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3	2									2
4	4									4
5										
6										
7										
8										
9										
10										
Total	7									7

ER 20, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	2									2
5										
6										
7										
8										
9										
10										
Total	2									2

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 21, Level A=0-8 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2		1							1	2
3			1						1	2
4	3		1	4				1	1	10
5										
6										
7										
8										
9										
10										
Total	3	1	2	4				1	3	14

ER 21, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2		3							1	4
3				4		1			2	7
4	1	1		5		1			4	12
5				1						1
6									1c	1
7									2	2
8				1						1
9					1#					1
10										
Total	1	4		11	1	2			10	29

ER 21, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1								1	1	2
2	1	1							1	3
3	1								4	5
4	3		1	2		2			4	12
5	1		1							2
6				1#					1¢	2
7										
8										
9										
10										
Total	6	1	2	3		2		1	11	26

ER 21, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	1		1							2
5										
6										
7										
8										
9	1#			1*						2
10										
Total	4		1	1						6

ER 21, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1	1	1	3					1	7
4	2			7					2	11
5										
6				1						1
7										
8										
9				1#						1
10										
Total	3	1	1	12					3	20

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER22 , Levels A-D=0, 0-40 cms; E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	3									3
5										
6										
7										
8										
9										
10										
Total	4									4

ER 23, Levels A=0-7 cm,0; B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3			1							1
4			1							1
5										
6										
7										
8										
9										
10										
Total			2							2

ER 22 , Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	2		2							4
5										
6										
7										
8										
9										
10										
Total	4		2							6

ER 23 , Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2								1		1
3										
4			1							1
5										
6										
7										
8										
9										
10										
Total			1					1		2

ER 23, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	4									4
3			1							1
4	4									4
5										1
6	1									
7										
8										
9										
10										
Total	9		1							10

ER 23, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7		1								1
8										
9										
10										
Total	1	1								2

ER 23, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4										
5										
6										
7										
8	1									1
9										
10										
Total	2									2

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 24, Levels A=0; B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3			2							2
4	1									1
5								1		1
6		1¢			1#					2
7										
8										
9										
10										
Total	1	1	2		1			1		6

ER 24, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	4									4
5										
6										
7										
8										
9	1#									1
10										
Total	5									5

ER 24, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3			1							1
4	1							2		3
5										
6					1					1
7										
8	1¢				1¢					2
9										
10										
Total	2		1		2			2		7

ER 24, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	2									2
4	1									1
5										
6	1									1
7										
8										
9	1#									1
10										
Total	5									5

ER 24, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	4									4
5										
6										
7										
8										
9										
10										
Total	4									

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 25, Levels A,B,C,D=1 point, 0-39 cms; B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6			1*							1
7										
8										
9										
10										
Total			1							1

ER 25, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4										
5										
6										
7	1¢									1
8										
9										
10										
Total	2									2

ER 25, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1	1									1
2	2									2
3	8									8
4	8								1	9
5										
6	1									1
7	1									1
8										
9	1									1
10										
Total	22								1	23

ER 25, Level H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1	1									1
2	4									4
3	11									11
4	19									19
5										
6	1									1
7										
8										
9										
10										
Total	36									36

ER 25, Level G

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1	2									2
2	6									6
3	7	1	1					1		10
4	22									22
5										
6	4									4
7	2									2
8	1									1
9	1									1
10										
Total	45	1	1					1		48

ER 25, Level I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1									1
3										
4	1									1
5	1									1
6										
7										
8										
9										
10										
Total	3									3

ER 26, Level A=0-8 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2		1							1	2
3			1	2					1	4
4				4	1				2	7
5										
6	1									1
7										
8										
9	1			1						2
10										
Total	2	1	1	7	1				4	16

ER 26, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1	2							3	6
3			2	13	1	1			7	24
4	6		2	9				1	4	22
5										
6				1						1
7										
8										
9										
10										
Total	7	2	4	23	1	1		1	14	53

ER 26, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1	3							2	6
3	3		2	1					3	9
4	2			2		1			2	7
5										
6	1(1#)									2
7									1	1
8									1	1
9										
10										
Total	8	3	3	3		1			9	26

ER 26, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3				1					1	2
4				1						1
5										
6	1								1	2
7										
8										
9	2#									2
10										
Total	3			2					2	7

ER 26, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3		1								1
4	4			1						5
5										
6										
7										
8										
9										
10										
Core Frag.			1							1
Total	4	1	1	1						7

ER 27, Levels A=0-6 cms, 0; B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4								1		1
5										
6	1			1						2
7										
8										
9										
10										
Total	1			1				1		3

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 27, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1			1						2
3										
4	1							1		2
5										
6										
7										
8										
9										
10										
Total	2			1				1		4

ER 27, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4			2	1						3
5										
6										
7										
8										
9		1#								1
10										
Total		1	2	1						4

ER 27, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4			1							1
5										
6										
7										
8										
9										
10										
Total			1							1

ER 27, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1		1							2
5										
6	1									1
7										
8										
9										
10										
Total	2		1							3

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 28, Levels A-D=0, 0-41 cms; E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4										
5										
6										
7										
8										
9										
10										
Total	1									1

ER 28, Level G=0; H

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6	1									1
7										
8										
9										
10										
Total	2									2

ER 28, Level F

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

ER 28, Level I

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3	1									1
4	1									1
5										
6										
7										
8										
9										
10										
Total	2									2

ER 29, Level A=0-9 cms

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2				1						1
3			1						1	2
4	1			4				1		6
5										1
6				1						
7										
8										
9	1									1
10										
Total	2		1	6				1	1	11

ER 29, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2		1	1	1					3	6
3	1	1		7					3	12
4	2		1	7				1	5	16
5										
6										
7										
8										
9										
10										
Total	3	2	2	15				1	11	34

ER 29, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1		1								1
2						1				1
3	2		1	3				1		7
4		1	1	7				1	1	11
5										
6									1	1
7										
8										
9										
10										
Total	2	2	2	10		1		2	2	21

ER 29, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2				1						1
3	1									1
4										
5										
6		1								1
7										
8										
9										
10										
Total	1	1		1						3

ER 29, Level E

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3				1						1
4	2									2
5										
6					1					1
7										
8										
9	1#									1
10										
Total	3			1	1					5

ER 035, Level 1

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7				1						1
8										
9										
10										
Total				1						1

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 035, Level 2

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2		1¢								1
3										
4										
5										
6										
7										
8										
9										
10										
Total		1								1

ER 98, Level A

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1	1	1	1						4
3										
4				3						3
5										
6										
7										
8										
9										
10										
Total	1	1	1	4						7

ER 98, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2			1	1						2
3										
4	2		1							3
5										
6										
7										
8										
9										
10										
Total	2		2	1						5

ER 98, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4				1		1				2
5										
6										
7										
8										
9										
10										
Total				1		1				2

ER , Level

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
Total										

ER 99, Level A

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2			1							1
3										
4	1		2	1					1	5
5										
6					1					1
7										
8										
9										
10										
Total	1		3	1	1				1	7

ER 99, Level B

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	1		1					1	2	5
3										
4								1		1
5										
6										
7										
8										
9										
10										
Total	1		1					2	2	6

ER 99, Level C

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2	2	1	1							4
3										
4	2			1						3
5										
6										
7										
8										
9										
10										
Total	4	1	1	1						7

ER 99, Level D

Raw Material Type

Flake Type	1	2	3	4	5	6	7	8	9	Total
1										
2										
3										
4	1									1
5										
6										
7										
8										
9										
10										
Total	1									1

DATE
FILMED

El

Raw

Flake Type	1	2	3
1			
2			
3	1		
4			
5			
6			
7			
8			
9			
10			
Total	1		

I

Ra

Flake Type	1	2	3
1			
2			
3			
4	1		
5			
6			
7			
8			
9			
10			
Total	1		

Flake Type	1	2
1		
2		
3		
4	1	
5		
6		
7		
8		
9	1'	
10		
Total	2	

Flake Type	1	2
1		1
2		
3	2	
4		1
5		
6		
7		
8		
9		
10		
Total	2	2

Flake Type	1	2
1		
2		
3		
4	2	
5		
6		
7		
8		
9	1#	
10		
Total	3	

Flake Type	1	2
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
Total		